

May 26, 1958

# How Sud Builds Jet Caravelle

## Satellites' Size, Thrust Compared

# Aviation Week

## Including Space Technology

A McGraw-Hill Publication



requires no wrench clearance...

IT'S THE "TINIEST" SELF-LOCKING NUT... ...IN THE WORLD!

Another "first" by Kayser—originator  
of every major improvement in  
self-locking nuts in the last 20 years!

We eliminated conventional hex nut  
wrenching surfaces to give you the  
Kaylock HSD, a two-part miniature self-  
locking nut that enables you to reduce  
your present space dimensions by much  
as one third! HSD self-locking nuts are  
installed by wrenching on the threaded  
nut element itself with standard open-type  
or socket wrenches 3 to 4 sizes smaller  
than required by standard hex nuts.

And because the wrench never reaches  
the mounting surface, tool damage is eliminated.  
Your Kaylock consultant can point out  
further applications in which the HSD  
offers definite advantages.

Ann. Table 1, catalog issue 74-40, 8-22 and 8-32

## KAYLOCK®

all-hand self-locking nuts



Pat. No. 3,014,691

COPY OF PATENT FOR INFORMATION

KAYSER MFG. CO., INC.—KAYLOCK DIVISION  
160, Angeles, Calif.—Wichita, Kansas—New York, New York  
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Box 60, Montreal, Quebec—Los Angeles, Calif.



Get the insight - by Kaylock.

NOW READY: THE SUREST ANSWER TO



DESIGNED TO MEET THE EXTREME REQUIREMENTS OF SUPERSONIC AIRCRAFT—THE GOODYEAR CAPSULE PROVIDES RECOVERY CAPABILITY FROM OFF-THE-DECK TO THE MAXIMUM OPERATIONAL ALTITUDE AND MACH NUMBER. HERE ARE THE FACTS:

Human Exposed to IF requirements of single and multiplace aircraft without exceeding present day ejection seat insulation envelope.

Rigid, sealed, and pressurized to protect the crewman from extreme temperatures and shockloads exceeding a ton per square foot.

Minimum drag area to reduce deceleration leads to the minimum time taken prior to landing.

An integrated stabilization and recovery system, automatically repositioned at the instant of ejection to position the capsule in the optimum trim attitude.

Ejection capability after a water landing and under water escape potential from ditched aircraft.

Complete gimballed equipment protected within the capsule structure—yet readily accessible after descent to earth.

This escape capsule has been designed to meet Air Force and Navy requirements. It is ready now to assist you, in present and future aircraft designs.

WRITE: Goodyear Aircraft Corporation, Dept. 916-AQ, Akron 15, Ohio.

ESCAPE CAPSULES : ONE OF THE PRIME CAPABILITIES OF

**GOOD YEAR AIRCRAFT**

# WHAT KEEPS IT ON TRACK?

Keeping America's missile program on the right track is one of the electronic industry's most important jobs. Andrea, with some of the best talent and facilities in the field, is doing its part to help.

For instance, Andrea has trained up with top defense organizations in solving a myriad of electronic problems occurring in critical and highly classified missile development. This is just an example of how the resources and manpower of Andrea can augment your organization in a wide range of electronic work.

Imagination, ingenuity, industry—the "hubbub" at Andrea, a company known to all departments of defense for consistent top-level quality performance in engineering and production of advanced electronic design.

Andrea can help you with your electronic problems. Write on your letterhead to:

## SYSTEMS DIVISION

**Andrea**

RADIO CORP.,  
Long Island City, N.Y.

A Pioneer Name in Electronics—  
Research, Development, Production,  
Weapons Systems, Navigation, Ad-  
vanced Intercommunication Systems,  
Semiconductor Applications.

## AVIATION CALENDAR

- June 2-4—National Telecommunications Conference, Loews Hotel, Atlantic City, N.J.
- June 4-6—Farnborough Aircraft Conference, 1968, Farnborough, England, Farnborough International Showground, Cheshire, U.K.
- June 4-6/West Coast Majorcomics San person oriented program by the Society of Avionics Materials and Process Engineers and the Majorcomics Association, include an Avionics Business Bldg., Los Angeles, Calif.
- June 4-6/Orlando Annual Conference on Precision Guidance sponsored by the Institute of Radio Engineers Professional Group on Production Techniques, Hyatt Regency Hotel, New York, N.Y.
- June 4-6—National Musical Meeting, Armed Forces Chaplains Assn., Hotel Tropicana, Atlantic City, N.J.
- June 9-12—Aerospace Solid State Seminar, Vakuum and Antennas, Emerson Radio Corp., Los Angeles, Calif.
- June 9-13—Fourth International Congress on Space Research and Congress Columns, New York, N.Y.
- June 15-18—Second National Conference on Military Electronic Station Park Hotel Washington D.C.
- June 19-21—Annual Meeting, Institute of Navigation, University of Illinois, Urbana, Ill.
- June 22-27—1st Annual Vakuum, Antenne, Schalt in Electronen Material, Hotel Sud, Boston Mass.
- June 23-27—Summer Ground Meeting and Air Transportation Conference, American Institute of Electrical Engineers, St. Louis, Mo.
- June 23-24—Summer Meeting, Western States Section, the Combustion Institute, University Hall, University of California, Berkeley, Calif.
- June 24-26/1968—Meeting, Andrea Co. (Continued on page 6)

## AVIATION WEEK Industrial Space Technology

May 28, 1968  
Vol. 48, No. 21

1968 will be another year of record growth in the space industry. Last year, the industry grew 12 percent, and it is expected to grow 15 percent this year. The growth is being driven by the need for more powerful communications satellites, larger and more complex scientific instruments, and more advanced navigation systems. The industry is also expanding into new markets, such as commercial satellite communications and deep-space exploration.

Two major trends are driving the growth in the space industry. First, there is a trend toward larger and more complex instruments. For example, the Hubble Space Telescope, which is currently under development, will have a diameter of 2.4 meters and a mass of about 10 tonnes. Second, there is a trend toward more advanced navigation systems. For example, the Global Positioning System (GPS) is currently being developed by the U.S. Department of Defense and will be able to provide accurate location information to within 10 meters.

Overall, the space industry is expected to continue to grow at a rate of about 10 percent per year over the next few years. This growth is being driven by the increasing demand for space-based services, such as satellite communications and navigation.

AVIATION WEEK, May 28, 1968

# TELEMETERING COMPONENTS for Severe Environment



**HIGH POWER RF SWITCH, TYPE 1486** will switch a transmitter from one antenna to another or from one receiver to another matching the transmitter for safe operating under power. This unit is also applicable for ground use. FREQUENCY RANGE: 215 to 230 Mc/s (other ranges on special order). ATTENUATION: 0.25 db, maximum. POWER RATED: 100 WATT R.F. C.W.; VSWR: 1.5 maximum. SWITCHING TIME: 15 sec average; max. 20 sec. LIFE: 200,000 cycles. D.C. INPUT TAKES 25 db down into mixed channel, sequence. Micro-faders break.

**ANTENNAS**, tailored to specific missile requirements.

## ENVIRONMENTAL SPECIFICATIONS FOR HIGH POWER RF SWITCHES, ANTENNAS, DIFFUSERS AND WINDSHIELD

- SWITCH: see p. 1486
- VIBRATION: see p. 1486
- TEMPERATURE: Type 1486: -40° F. to +250° F.  
Antenna and Type 1331: see p. 1331. Type 1331 model of these units is provided as options and the use is to +250° F.
- TYPE 1331: Color: black. Weight: 17 lb. between 70° and 210° F. Operating temperature as low as -40° F.
- ALTITUDE: Uncoated Al units are hermetically sealed



## DIPLEXER CAVITY, TYPE 1331

Two Deployer Cavities and cavity components DUPLEXER which feeds signals from 2-100 watt transmitters via a single antenna system. Frequency range: 215 to 230 Mc/s, other ranges on special request. Spacing: 3 Mc/s min. Size and Weight: cavity approx. 2" dia. x 4" long. DUPLEXER with characteristics similar to Type 1331 can be supplied.



**VISIR MONITOR, TYPE 1373** This unit receives RF Power, VISIR and Soft-Tone amplitude and frequency. Two 12-volt voltages representing incident and reflected power as well as return power measurements may be used. Frequency range: 100 to 400 Mc/s. Beam width: 10 degrees. Resolution: 100 to 500 pixels. Input: 100 ohm Frequency Range: 100 to 400 Mc/s. Recovery time: 100 microseconds. Frequency estimated at desired frequency.



**HYCON EASTERN, INC.**

25 Cambridge Parkway Dept. IV Cambridge MA 01439

**HERE IS THE REMARKABLE  
ROTARY ACTUATOR**  
DESIGNED BY **CLEMCO**  
**AERO PRODUCTS, INC.**

opening up new horizons in the field of aircraft and guided missiles for the world today...for the universe tomorrow



HOW CLEMCO ANNOUNCES NEW FEATURES WHICH COMPLETELY REVOLUTIONIZE ROTARY ACTUATOR PERFORMANCE!

New CLEMCO developments in seals have now for the first time overcome the leakage factor and have made possible the first true

CLEMCO has developed a new and different and you can

which consist of

rotary actuators or

with complete assurance of structural integrity.

**NOW, THE THEORETICAL ADVANTAGE OF ROTARY ACTUATORS BECOME A REALITY!**

Here's the proof! Internal leakage at less than .06 G.P.M. at 3,000 P.S.I. with static deflection of less than .02 inch pounds in six inches plus a weight reduction of 50% and a total length-reduced for 30 inches. A lower value of internal leakage is practical at the expense of increased static friction.

**REMEMBER, CLEMCO HYDRAULIC ACTUATORS ARE CUSTOM DESIGNED**

For all regular aircraft and missile applications and can be furnished in an almost unlimited variety of construction sizes, temper ratings, and dynamic spring constants.

**CLEMCO AERO PRODUCTS, INC. are furnishing the leaders of the aircraft industry with the following products:**

- ROTARY ACTUATORS
- POWER SYSTEMS UNITS
- HYDRAULIC AND PNEUMATIC UNITS FOR AIRCRAFT AND COMMERCIAL AIRCRAFT AND MISSILES
- HYDRAULIC PUMP AND CYLINDER
- HYDRAULIC SYSTEMS
- HYDRAULIC AND PNEUMATIC UNITS FOR AIRCRAFT AND COMMERCIAL AIRCRAFT AND MISSILES

Write for complete CLEMCO folder to

**CLEMCO**  
**AERO PRODUCTS, INC.**

310 S. Mission St., Compton, California



**AVIATION CALENDAR**

(Continued from page 5)

Manufacturers Association, Mount Washington Hotel, Boston, Mass., N.Y.

June 27-Fair, Motor Boat Helicopter Show, sponsored by the Bureau of Aircraft and Street Institute of Technology, Shreveport Institute of Technology, Shreveport, La.

July 8-11-The Institute of the Aerospace Sciences, National Science Meeting, Vineland Hotel, Los Angeles, Calif.

July 14-16-The Institute of the Aerospace Sciences, National Science Meeting, Vineland Hotel, Los Angeles, Calif.

July 24-26-Fifth Annual Symposium on Computers and Data Processing, Atlantic City, New Jersey.

July 24-26-Annual Regional Meeting, Assn. of Local and Technical Airlines, Denver, Colo.

Aug. 4-8-Special Technical Conference on Space Missions and Vehicular Propulsion sponsored by the American Astronautical Society, Hyatt Regency Hotel, Atlanta, Georgia.

Aug. 11-15-Conference on Electron Devices and Measurements, National Bureau of Standards, Boulder Laboratories, Boulder, Colo., jointly sponsored by the National Institute of Standards and Technology, Boulder, Colo.

Sept. 27-28-Mechanical Dynamics Research, Engineering Seminar, Pennsylvania State University, University Park, Pa.

Sept. 29-30-Ordnance Products Show, a Convention Institute of Radios Engineers, Washington Hotel, San Antonio, Calif.

Sept. 29-30-National Conference on Advanced Personnel Education, Inc., Station House, Holland.

Sept. 30-Oct. 1-1956 Eurofrough Flying Display and Exhibition Series at British Airports, Convention Eurofrough, Toulouse, France.

Sept. 3-5-1956 Congress, Explorers Conference, American Society of Teachers, Cos Cob, Conn.

Sept. 4-6-1956 International Congress of the American Sciences, Palace Hotel, Madrid, Spain.

Sept. 15-19-Annual Instrument Automation Conference & Exhibit (Instrumentation) in honor of 50 years of Service, Philadelphia Convention Center, Philadelphia, Pa.

Sept. 22-24-1956 Annual Meeting, International Society for Technology and Research, Central American Hotel, Manila, Philippines.

Sept. 23-26-1956 Annual Meeting, Standards Engineers Society, Roosevelt Hotel, Philadelphia, Pa.

Sept. 23-26-1956 Annual Meeting, American Society of Architects, Engineers, Inc., Auditorium Hotel, Los Angeles, Calif.

Oct. 12-14-1956 Annual General Meeting of the International Air Transport Assn., New Delhi, India.

Oct. 17-19-1956 East Coast Conference on Avionics & Navigation Electronics, Institute of Radio Engineers, Hotel Statler, Baltimore, Md.

advertisements and production by Hoffman

**Hoffman**

# GYROS

FOR INERTIAL NAVIGATION  
AND GUIDANCE SYSTEMS

Center Machines and Equipment

Computer-Aided Design

Automatic Guided Vehicles - New software

Computer-aided problem-solving

of Hoffman's computer system

of aircraft systems

and components in electronic and

mechanical systems

and mobile systems

using the latest technology

means of the space, aircraft,

missiles and electronic industries

100 million dollars per year

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100 million dollars per year



**Ground Speed & Drift Angle  
Any Time, Anywhere, Any Weather**

One look and the pilot KNOWS  
In a minute he reads several ground  
speeds and drift angles.

This valuable information available  
is displayed on the flight panel  
automatically and continuously.

The RADAN system is one of  
the first revolutionary Doppler weather-reporting systems. Other plasma  
and sonic detection systems will when

you see and how to process what you're  
going. The system operates entirely  
infrared, so it can't be seen or heard. It  
has passed thousands probably in  
millions of operational miles.

Get a new perspective on the rea-  
son for the success of Doppler weather  
radar in air navigation. Write for additional  
information on magnetics in  
the breaking of the visual barrier.



## RADAN joins the jet crew

Today's military and jet-liner crews have an  
added member—an 80-pound navigator named  
**RADAN**!\*

Guiding the plane with pinpoint precision, telling  
the pilot his exact velocity second by second—working automatically, continuously, without fatigue—**RADAN** takes a big load off the rest of the crew. More important, it adds immeasurably to the successful completion of military missions.

**RADAN** navigators are members of the famed GPL family of Doppler systems developed in conjunction with the USAF (WADC). GPL auto-navigators have literally revolutionized flight. They are the only

self-contained systems in the world proved over millions of operational miles.

Recent release of **RADAN** Systems for civilian use now makes their benefits available to everyone. **RADAN** saves time and precious fuel for the air lines, provides a priceless margin of safety for all.



GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N. Y.

\*Trademark

GENERAL PURPOSE ELECTRONIC EQUIPMENT, INC., THE OFFICIAL SOURCE FOR REPRODUCTION INFORMATION. SIC issued by Patent Office

VII

This is the seventh in a series of advertisements dealing with basic facts about steel castings. Though it is not all the information is necessary, we believe it will be of interest to anyone in the field, including men of broad experience who may find it useful to review fundamentals from time to time.

## Quenching Media for Alloy Steels

In the quenching of alloy steels, several points require consideration, among them being the size and shape of the piece, the type of steel involved, the quenching medium, and proper agitation of the quenching bath.

The composition of the steel has an important bearing on the selection of a quenching medium. As an example, shallow-hardening steels require a fast cooling rate, whereas deeper-hardening steels require progressively slower rates as the alloy content increases.

Three commonly used types of quenching media for alloy steels are water, oil, and air. These are discussed below in the order of quenching severity:

(1) **WATER.** Fresh water is entirely satisfactory only when used as a flush. Salt-water solutions are generally used in still baths to avoid the bad effect of bubbles resulting from dissolved atmospheric gas. It should be noted that the quenching rate drops as water temperature is increased. The range of 70 deg to 100 deg F is recommended.

(2) **Oil.** An oil quench cools more slowly than water, and faster than air. Oil-hardening steels can be hardened with less distortion and greater safety than water-hardening steels. Mineral oils are generally used because of their low cost and relatively stable nature.

(3) **AIR.** If sufficient alloying elements are present, critical cooling rates are decreased to the extent that certain steels can be quenched in either still or forced air.

While the choice of quenching medium is of prime importance, there is another factor that should not be overlooked. This is the agitation of the quenching bath. The more rapidly the bath is agitated, the more rapidly heat is removed from the steel, and the more effective the quench.

Bethlehem metallurgists will gladly help you with any problem related to quenching or other phases of heat-treatment. They are men of long practical experience in this field, and they understand fully the advantages and limitations of each method. Always feel free to call for their services; their time is yours, without obligation.

Remember Bethlehem, too, when you are next in the market for AISI standard alloy steels, special-alloy steels, or carbon grades. We are always in a position to meet your needs promptly.

**BETHLEHEM STEEL COMPANY**

BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation, Export Division; Bethlehem Steel Company; and



**BETHLEHEM STEEL**



## New Jet Engine Trainer now available to airlines

Link Aviation announces the availability of a unique Jet Engine Trainer that provides ground and flight crews with thorough instruction in jet engine operation.

This Trainer, which has already been ordered by United Air Lines, Trans World Airlines and Continental Air Lines, trains personnel not only in jet engine theory and operation, but in proper maintenance procedures as well.

Link's Jet Engine Trainer will give United, TWA and Continental personnel valuable, realistic experience in starting, operating and shutting down a simulated jet

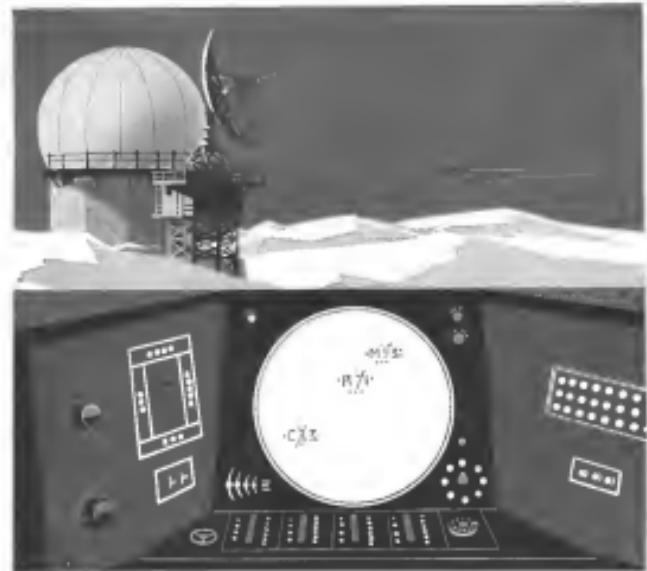
engine under widely varying conditions of altitude, air speed and outside temperature. Maintenance crews will gain valuable insights into repair procedures since the Trainer faithfully simulates failures and near failures—something which could not be duplicated on an actual engine without damaging valuable equipment.

The Link Jet Engine Trainer adds a new dimension to the capabilities of commercial and military aviation by providing the most efficient, most economical means ever devised for thorough jet engine training.

Send for free brochure  
on Link's Jet Engine Trainer

**LINK AVIATION, INC.**  
BINGHAMTON, NEW YORK

**LINK**



From radar antennas to "readout" equipment...

## AMF has experience you can use

- Giant search antennas made by AMF form a vital part of the nation's air surveillance network
- And converting the incoming radar signals into instantly understandable information, one brain-like AMF Electronic Data Display System. The ultimate in "readout" equipment, these compact console units accept either analog or digital information, instantly convert, coordinate, and display the data on the face of a cathode-ray tube. Incoming signals can be interleaved with synthetic symbols for immediate reference, and any segment of the display can be panned and enlarged whenever desired
- See for yourself why, for radar control of air, ground, and harbors, or for general-purpose computer reading, AMF has the experience and equipment you can use.

- Aircraft
- Ballistic
- Radar
- Control Room
- Radar-Computer
- Airflow-From-Outside
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# SYLLOGISM FOR TOMORROW

PREMISE

Today's advanced Control Systems technologies  
are the result of military research and development.

PREMISE

Tomorrow's industrial Control Systems will utilize  
the most advanced technologies of the Control Sciences.

CONCLUSION

By virtue of its advanced facilities and laboratories in Harrisburg, PA,  
Amp Telecomputing Corporation is best qualified to meet your systems or  
industrial Control and Control Evaluation problems of today and tomorrow.

## INDUSTRIAL APPLICATIONS OF TELECOMPUTING CORPORATION

**BE**  
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**BRIDGE ELECTRONICS** An A-MP feature  
is the fast, full-speed real-time control system  
for shipboard automated equipment —  
any system analysis — for traffic  
control, navigation, communications, and  
electronic equipment.

**WG**  
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**MICROCOM** Loading problem of

electronic memory has been solved by

new solid-state, rugged, error-free circuitry

and microprogramming techniques —

the result can be up to 10 times faster

than present — speed and time reductions

**DI**  
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**MAIL INSTRUMENTS** Programs in

memory for fast and accurate analysis

of printed forms, tags, or printed lists

— for electronic and analogic loads,

indicators and electronic applications.

**ES**  
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**DATACOM SYSTEMS** Operators in

real-time receive and analyze data from

multiple sources and automatically

handle data reduction for easy selection

of data from all forms of data

**WC**  
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**WEAPONS CONTROL** The largest

operator and controller of combat aircraft

systems — for fighter jets, bombers,

and fast jets, missiles, and projectiles

for advanced mission, aerial, and

satellite applications.

**NI**  
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**INDUSTRIAL INSTRUMENTS** Analysis and

selection of quality, cost-effective

instruments for industrial processing and

monitoring of nuclear weapons.

TELECOMPUTING CORPORATION  
300 EAST STONY RUN, HARRISBURG, PENNSYLVANIA



**FIT  
TO  
FLY**

**AMP**

... raises lightning fast in-flight reprogramming of  
airborne electrical/electronic circuitry ... obviates fixed  
circuit connectors and other systems requiring hours or  
days to service ... and offers these unusual features

- removable patchboards to permit complete reprogrammimg in seconds
- 3 1/2 pounds to minimize weight ... minimized to conserve space
- rugged shock and vibration-resistant construction with high strength aluminum alloy
- shock-resistant seating of patchcord plugs in removable board
- AMP's patented wiping action that pre-clears contacts for top electrical performance
- 240 contacts for greatest versatility in circuit combinations or program arrangements

For more information on this new airborne wiring technique, AMP's Patchcord System Catalog is available on request.

**AMP INCORPORATED**  
GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

A-AMP products and engineering assistance are available through wholly-owned subsidiaries in Canada • England • France • Ireland • Japan



## ARMA'S SECRET WEAPON

Bug hunting... airflow testing... safety factors... flight testing—some of these traditional reliability concepts are sufficient to insure mission performance of missile guidance systems.

We use them all at Arma—but the designer's

pen is our "secret weapon." For true reliability must originate at the design stage—and then be implemented by a full-scale quality control and reliability program. ARMA . . . Garden City, N. Y. A division of American Bosch Arma Corporation.

604

## Arrowhead Ducting Design provides Safety Extras!



As an important part of the cabin pressurization and air mixing system, this double delta duct provides a fan safe diffuser which can withstand pressures of 18 to 45 psig and a temperature range from -40°F to +400°F with a life of 70°F.

### FOR THE DOUGLAS DC-8 JET AIRLINER

A unique *arrowhead* duct with a duct journal was built by Arrowhead to perform an extraordinary safety function in the bleed air duct system of the new Douglas DC-8 Jet Airliner. This ducting component provides a "fail-safe" device which signals a warning when excessive leakage develops in the outer duct. The outer duct provides operational safety and the aircraft can be serviced.

Constructed of Arrowhead's Arcoil® 27 materials, this double duct has withstood such tests as 185 psig pressure and deflection cycles... vibration accelerations to 13 Gs... 180 psig pressure... and closed flame (200°F) for 13 minutes.

This remarkable double duct is only one example of the many customer design problems which are solved by Arrowhead every day. Whether your ducting problem is complex configuration... pressure and temperature... or resistance to oil and abrasion, the Arrowhead engineering and design group can help you.

For engineering consultation, contact the Field Service Representative in your area or write to the factory direct. Request "Technical Bulletin S-18K."



**SAFETY X1:** Double Delta—A duct with a duct journal to resist emergency leak rates.

**SAFETY X2:** Fan Safe Diffuser—Wipes off excessive leakage of outer duct.

**SAFETY X3:** Quick-Connect Coupling—Fan-safe type can be specified for fast simple installation.



AMERICAN BOSCH ARMA CORPORATION

INSTITUTE A-2023-2



The transmitter and its Model 3113 Transmitter is supplied in a cabinet 20 in.  $\times$  12 in.  $\times$  14 in., with no weight or dimensions.

- POWER AMPLIFIER**
- 25-83 db Intermediate Selection
  - Designed in the existing space limitations of an advanced general telemetry receiving system used in missile range instrumentation. Provides for coupling to its main receiver and a single common output. High degree of isolation between outputs (50-83 db) effectively eliminates spurious and interference problems.
  - Working range of 100-3000 cps and a bandwidth of 30 cps.

Bulletin RAD B-106



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MODEL 8-100



MODEL 3-100

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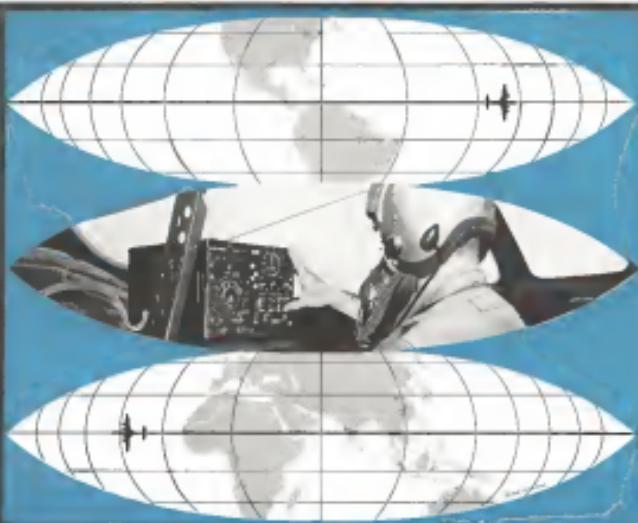


- MODEL 3115**
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Bulletin RAD B-106

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# Aviation Week

Including Space Technology

Vol. 88, No. 21  
Member AIP and ABC

May 26, 1968

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## AVIATION WEEK

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## AVIATION WEEK, May 26, 1968

### Electromagnetic Warning Systems Studied

► Proposals for "defensive impulse" warning screen for anti-CIAIR, border detection studied by AFPA

### Airlines Split on No-Show Control Plan

► American battles to have plan dropped, Eastern, National, Northwest ask for continuation

### Scientist Compares U.S.-Red Satellites

► Size, thrust and other performance data is calculated for Sputniks, Explorers, Vanguard

### SPACE TECHNOLOGY

Scientist Compares U.S.-Red Satellites  
Space Agency Legitimizes  
Four Objects in Synthetic Orbit  
Navy's Space Station  
No Entry May Is Red Problem

### MISILE ENGINEERING

Missile Propulsion  
Army Checks Safety Factors

### AERONAUTICAL ENGINEERING

Tutor Jet A3J  
New Jet Radios Control Jet Transport  
Germans Buy A3J  
EPA Sets 20% Weight Limit  
Kingspan Industries' First Flight  
North American XTR Prototype

### AVIATION

Microstripes Win NASA Award  
FCC Throttles Down Broadcast  
2 Star Army Board Postponed  
High Level Radiation Posited  
Industry: Expenses, Changes

### EQUIPMENT

Airline Handling Becomes Big Business  
What's New

### EDITORIAL

Supersonic Transport Review

► GE: Testing, structur et completed on Stratospheric Airlines Stratoliner's second Star Aviatic Canadair. Test flights are being made at this month's low levels in Toulouse. First production Canadair made its first flight last week at -40 m.s. at 21,000 ft. A second flight at -40 m.s. was made the same day. For Canadair production story and other photos, see page 68

### PILOTS' QUOTE

► Flying, 20, 21, 22-Bethlehem, 22-J. V. Taylor, 2d; Allentown, 20-21 Army, 45—James, 20—John, 21, 22, 23—Bob Roberts—makes West 75-Bell Atlantic, 22—James—McGregor, 20, 21—Gause

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# EDITORIAL

## Supersonic Transport Era

One of the first things we learned in the aviation writing business was about the pitfalls that await for our writerly protégés in this field. Since the day Orville Wright first got off the sands of Kitty Hawk, the galloping pace of aviation technology has made a habit of surprising even the most sagacious to be ultra-conservative in retrospect.

And, so it appears to be now in the jet transport business. For the past few years in a series of jet transport prototypes took to the air and entered the international sales competition, the prophets also have been busy forewarning. Their forecasts generally predicted at least a decade of subsonic jet transport operations in the 500-600 mph speed range, with the supersonic transport looming on the technical horizon 10 to 20 years hence.

But galloping technology is already challenging these once reasonable estimates. A few weeks ago (AVW May 12, p. 23), we published the fact that Douglas Aircraft Co. was already well along on a Mach 2 transport design for both military and commercial markets. The wings of Santa Monica are holding their options open, and pretty close in these years, and there is no hard-dated available on this project. But it is obvious that the Douglas supersonic transport is based heavily on DC-8 design experience and transport development. Turbogeared at the 34,000 ft thrust class without afterburning are already running on test stands.

### Douglas Timetable

It seems reasonable to expect Douglas to be ready to fly its Mach 2 prototype in about two years—a far swifter timetable considering the first DC-8 is making its first flight in about November.

Across the hills in Burbank, Lockheed engineers are more conservative about their supersonic transport philosophy. However, we spent some pleasant hours with Hal Hibbard, senior vice president of Lockheed Aircraft Corp., on this subject. Lockheed has its sights set on a transport that will cruise 3-4000-7,000 mph—plus in its entry to the supersonic jet transport competition. This is truly a breath-taking commercial vista—New York to Los Angeles in 40 minutes, across the Atlantic to London in two hours and transpacific in half a day.

How sure, the time scale is amazingly short. If designs were begun now—and it is perfectly feasible to do so, Mr. Hibbard assured us—it would be possible to produce a prototype in about two-and-a-half years, take a year for thorough flight testing, have it in production by about 1961-62 for initial operations beginning in 1965.

The Mach 3 transport design is still within the state of the art made possible by our superb and successful plough into the supersonic speed range during the past decade. Flight experience with piloted aircraft such as the F-104 Starfighter in the range through Mach 2 and with model test vehicles such as the X-7 in the

snowy peaks Mach 4 have proved that theoretical projections of Reynolds numbers were far too conservative. Much better results have been achieved in actual flight testing than were anticipated with the slide rule and wind tunnel. Calculation of the increase in drag as speed increased beyond Mach 1 were far higher than have proved to be the case.

### Seat Mile Cost

Mr. Hibbard believes that the Mach 3 transport will cruise in the 50-60,000 ft altitude layer, carry 85-100 passengers over stages lengths of 1,000 miles and up at a seat-mile cost 20% lower than the current crop of subsonic jet transports. The Mach 3 transport could use existing runway because of the tremendous power required for high supersonic cruise and the relatively low wing loading necessary for high altitude performance.

These also will be well developed powerplants available well within the time scale outlined by Mr. Hibbard. There are indications to the 60,000 ft thrust class using titanium P4 jet engines without any exotic combinations and additives. The same Reynolds numbers dividends predicted for turbines as applied to the axial compressor and turbine blades in the high supersonic range may not even be necessary to go to a turbo-nacelle combination. Who would have thought a few short years ago that a straight nacelle could be seriously considered for Mach 3 to Mach 4 performance?

Such well tested gains in the jet engine business as General Electric, Pratt & Whitney Aircraft and Rolls-Royce are all offering nacelles to meet this Mach 3 transport requirement.

Perhaps the most serious problem of the Mach 1 transport will be its passenger environment—assuring full safety in the pressurized capsule that will take man in routine flight far beyond his natural capabilities. In general, the passenger would wish to wear the type of space suit (planned for Scott Crossfield and his X-15 venture) even for a few hours as a safeguard against decompression.

### Airline Reaction

New divisions of the Mach 2 and Mach 3 transports may be fine news for the traveling public, particularly the business executive whose day never seems long enough. But we can safely predict that not all airline presidents will view this tremendous technical progress as an unmitigated blessing.

To airline executives are butting the rising cost curve and demanding load factor square simultaneously with the financial and operational problems of beginning massive jet transport operations, this may seem to be "too much, too soon."

These problems we will save for discussion another day.

—Robert Floty



Photo courtesy Sikorsky Aircraft Corp.

## MAGNESIUM ALLOYS BUILD BIGGER PAYLOADS INTO SIKORSKY 'COPTERS

Structural dead weight—but ever critical problem in the design of an aircraft and missile—is a problem Sikorsky Aircraft solved several years ago.

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The S-55, Sikorsky's largest transport to date, carries a total of 5,200 lb of magnesium. The total includes the wheels, almost the entire skin and numerous other components. Several highly stressed areas, such as the rotor hub plates,

are magnesium forgings. Other Sikorsky models with as the S-56 and S-58, former Korean War targets, also use magnesium alloys to good advantage.

For more information about magnesium, contact your nearest Dow Sales Office or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 14002-1.

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## WHO'S WHERE

### In the Front Office

**Tom W. Evans**, president, The Hafford Corp., subsidiary of The Singer Corp., El Segundo, Calif. Mr. Evans formerly was exec. v.p. of L. Braggman who continues as chairman of Singer's executive management committee.

**Richard H. Bierhoff**, a doctor and ex-captain, now president, Vickers-Armstrongs, Inc., Atlanta, Ga.

**Robert B. Manz**, vice president of Defense Aircraft Engines Corp. will manage the effort of United Aircraft Export United Aircraft Service Corp. and Sikorsky Aircraft Co. General Dynamics has arranged for Manz to head Sikorsky. Manz was asst. to M. M. Moore. L. R. Shultz, company representative and Richard Stephenkay and Edward Bleeding, test pilots for the Sikorsky group in California.

**Herbald Mackie**, ex-v.p. of General Electric's Radio and Space Div. has joined the Board of Directors of the company. Mr. Mackie is a trustee to the pension fund.

**Geno D. Dickey**, a vice president, Sovra Machinery Inc., Hawthorne, Calif.

**Alan M. Cloer**, vice president, Scott Engineering and Manufacturing, Inc., Boston, Massachusetts, Somerville, Mass.

**William D. Hunsaker**, vice president, Lockheed Aircraft, Sunnyvale, Calif., Inc.,

**Robert J. Higley**, vice president-chairman, Hovey Aviation Co., subsidiary of Hovey Corporation, El Cajon, Calif.

**Cloud Breuer**, a doctor and exec. v.p. president of Consolidated Electrified Devices Corp., Stamford, Conn., elected group vice president for the company's Avionics Products and Test Equipment division and West Coast manager.

**George M. Hinckley**, a doctor and exec. v.p. president, Acoustics Associates, Inc., Worcester, Mass. Mr. Hinckley is general sales manager. Also: William P. DeLoach, Jr., a vice president responsible for West Coast business, Culver City, Calif.

**Andrew R. Marshall**, vice president, Avco-Spartan, Worcester, Mass. Mr. Marshall succeeds Mr. Hinckley as general sales manager. Also: William J. Petrik, general manager, and Robert B. Kastin, treasurer.

**Cpl Albert J. Wozniak** has been appointed Major Defense Procurement Agent, TACIR Program, Cpl. Wozniak succeeds Col. Paul F. Blaylock, who has designated head of the new Department of Armaments at the Air Force Academy, Denver, Colo.

### Honors and Elections

**Gen Curtis E. LeMay**, USAF Vice Chief of Staff, has been named recipient of the Charles L. Grier Award, presented annually by the New England Society of Engineers. The citation reads: "In recognition of your outstanding career in the field of your profession." Gen. LeMay will be cited in his 30th year in military service.

**Kenneth M. Wissner**, consulting engineer at The W. L. Marston Corp., has been awarded a Doctor of Science degree by Columbia University for his original contributions in the field of electronic engineering.

(Continued on p. 119)

## INDUSTRY OBSERVER

**Pratt & Whitney JT12 turboprop engine** which is now running on the test stand at 2,900 hr. static thrust under regulated Mach 2 conditions was developed from drawing board to successful operation in less than four months. Zagac is a single spool design rated at low specific fuel consumption. It is suited for applications in the UCX and UTX Air Force aircraft and executive jet transports. Design was completed in January and first engine ran successfully on the test stand early this month. JT12 weight 490 lb.

**Future technique** for detection of Soviet missile firings by the reception of ultrahigh-frequency energy generated by rocket engine gases first disclosed by *Aerospace Week* (AW, May 12, p. 21) will be integrated into Air Force's balloon-borne early-warning system. With further sophistication, technique will not only reveal point of launch but also duration of flight and velocity at launch, thereby providing data for determining the appropriate point of impact.

**Air Forces** may soon launch a major program to apply infrared to its early warning airborne systems to make up for deficiencies in present radar detection. Airborne infrared warning systems can be equipped with infrared systems designed for air-ground, hostile aircraft and ballistic missiles. Operating above altitudes of 20,000 ft, it would largely eliminate atmospheric attenuation which hinders ground-based infrared surveillance systems.

**Uninterpreted** and unexplained high cosine signal detected by Explorer I and III satellites (AW May 5, p. 34) will be analyzed directly in a new experiment to be made this summer aboard another Explorer. Original high cosine air current measurement was based on deflection rather than signal measurement.

**Navy** has moved into the development stage of a new chemical aircraft designed to use high-energy laser beams. Navy feels that adoption of existing aircraft to high-energy tasks might be about as costly, much less productive.

**Radiately different type infrared detector** which may prove to be a real killer when more sensitive than present lead sulfide detectors with response times of less than one microsecond is under development by Thomson Corp., Madison, Wis. Detectors, which operate on an entirely new principle, can be electromechanically tuned to be sensitive to any portion of wide infrared spectrum.

**New family** of chemical compounds that shows strong resistance to nuclear radiation and moderately high temperature has been developed by Wright Air Development Center's Atmospheric Research Laboratory. New non-polar, called perfluorinated dienes, consist of molecules made up of sixteen atoms and associate (with groups). Above temperatures of approximately 100°C, the new chemicals in a liquid, suggesting possible use in hydraulic systems or as dielectrics in atomic equipment.

**Electronics** gas sensor based on new principles which require no moving parts have been proposed in three different companies to Wright Air Development Center's Weapons Guidance Laboratory. None of the three sensors is a product of conventional gases. None of the systems may provide continuous monitoring according to a WADC spokesman. All three will ultimately be used for electronic countermeasures and strategic bombers. Separate determination of performance due to vibration, WADC also has received a proposal for a novel accelerometer which has no moving parts.

**Navy** is now evaluating a Liquid-loaded Doppler-echoence altimeter unit on a Sikorsky HSS-1 helicopter/helocarrier designed to provide pilots with greater accuracy in holding position while dropping a target load that is of current importance. Unit would be to helicopter's automatic stabilizer gear to give accurate hands-off control of the helicopter at low altitudes. Navy program calls for firework calibration of the gear in approximately one year after completion of tests if evaluation is successful. Helicopters carrying the gear would be redesignated HSS-2N.



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## Washington Roundup

### Air Defense Cuts

After cutting its air defense budget for fiscal 1959 about 20%, senior Air Force officials now are looking for further early warning plane, surface-to-air interceptors (Convair F-106) and anti-ground missile (Boeing Bomber). Cut is caused by cancellation of demand USAF places on defense contractors and appearance of new mission requirements that will require larger research and development commitment for future programs. Technical Air Command also will take another cut, mainly in the Republic F-105 program.

### Collision: New Demands

New demands for sharper control of aircraft and more rapid traffic control procedures were last week in the wake of the mid-air collision near Maryland between a Capital Airlines Vickers and an Air National Guard F-104 jet plane. Thousands of passengers demanding that marking be done around Capital Hill in topical fashion. And Congressmen, again in typical fashion, presented more full-dress probes into the mid-air collision board which probably will add to the publications beatings that already have been held on the subject without resulting in much more than pointed confirmation of original charges that something went wrong.

However, positive action came from at least one Senate Meeting in Kansas City, the Air Transport Committee east of the Air Transport Association said, to expand positive control of aerial traffic. All was advanced by one vote in a group of 10 aircraft carrying over 10,000 ft in altitude to 10 under 10,000 ft.

Originally, the plan was to reduce the ceiling to 15,000 ft on July 1 and to 10,000 ft by July 1, 1959. Now the conference will propose that the ceiling be dropped to 10,000 ft on July 1, beginning the interim 13,000 ft. The conference also passed a resolution calling for a single system of aircraft separation coupled with a demand for rigid coordination and interchange of flight information between all aircraft.

### CAA Rejection

Meat by a House Appropriations Subcommittee to implement changes in traffic control measures was rejected last week by the Civil Aeronautics Administration as grounds that early action would prevent problems of aircraft separation between Subcomittee Chairman Price H. Fletcher (D-Ga.) decided to appeal his rejection to President Eisenhower but told the President's schedule would not permit an appointment to discuss the appeal. Fletcher later learned that the President's schedule included a round of golf at Washington's Burning Tree Country Club.

### Lunar Issue

Rep W. Johnson, director of Defense Department's Advanced Research Projects Agency is asking that certain atomic explosive projects be allowed to continue after the creation of a civilian space agency. He told the House Appropriations Committee:

"At the moment I am not quite sure there is military advantage in the area of the moon, but we are down there now so..." Arguments have been made in more

of the scientific literature that it is ridiculous to drop bombs from outer space. A bomb will not kill less that height, but perhaps a death ray could be created in the near future year."

"Getting up 90 miles in the air with a draft on might be a perfect mix to develop an atom or an atom's effect on us. Congressmen are sure that because a bomb will not drop from 900 miles it means that when we bomb Earth's atmosphere won't be the only identifiable weapon. We have to think of new weapons... There may be weapons that will be used to gain advantage in outer space than that would be on Earth. If that happens and then never used against us, I think that in the year 1958 we should have made a tough man take if we wouldn't and military people have no right to operate in outer space."

### Defense Reorganization

What really looks like a knock-down fight between the President and House Armed Services Committee over how the Defense Department should be reorganized has flushed into a controversy over two parallel much authority should the Secretary of Defense have to (1) transfer and align the responsibilities between the services and to (2) direct the administration of the individual military departments. The President wants the Secretary, to have a free hand to do both. But House Armed Services Committee charged on the shoulder. Under the legislation approved by a 12 to 8 vote last night in a single combatant function would have to be transferred to Congress for review. Another committee proposal is for separate organization of the three military departments with the stipulation that the Secretary of Defense controls his power through the respective committees of each department.

### Hector Books Airlines

Civil Aeronautics Board member Louis J. Hector said last week that the Board would not be subordinate to any panel for that of the safety of fire proposals by the industry are not equal to reasonable. Using a direct of the States Alaska fire crew to expose his views, Hector said he had gained faith in the industry's ability to cope with problem on the spot that in the interests of governmental equality sitting in Washington. He said that state does not prevail, that the Board shall not all rights for its transportation and added: "Nothing is too much harder, or in the experience of regulated transportation, than to make a decision in a matter of safety in manner most favorable to governmental decree. When this happens it causes that true interpretation to the fire plan of concrete faces has broken down."

### Satellite Memorial

A move is under way in Congress to erect a marker at Air Force Muroc Center, Cape Canaveral, Fla., to memorialize the launching of Explorer I, the first world's first earth satellite. A joint resolution calling for the Defense Secretary to provide the marker and a suitable inscription was introduced in the House by Rep. Robert E. Jones (D-Ala.). Jones said the size of the marker probably should be considerably larger than the first U.S. satellite that was placed in orbit.

—Washington staff



Committee on Astronautics and Outer Space to be composed of nine members.

\* **Powers**: the government's intent is an intention of distinctly valid under color of law to regulate the affairs of the country in the functions of the agency.  
• **Calls** for the administrator to engage in a program of international cooperation in carrying out space activities and the peaceful application of the results.

In a report that accompanied the bill, the committee said the President's proposal to create NASA was a good step in the right direction. It added, however, that evidence required during the hearings indicated that the bill would provide for further legislation.

The structure of the organization should be strengthened and widened, the committee said. It added that the command functions should be far more securely established and its relation sharply with other agencies more clearly set forth. It also said it is to be the ultimate function, however, to have authority of its own.

The report added that establishment of the agency is not simply a matter of

organization. It will, it said, "in the end stand or fall in the quality of the men who direct it, therefore, the selection of leading officials for the agency is a matter of extreme importance."

In the joint hearing and operation of space programs, the report said, "the principal problem has been the relationship of the civilian to the military. It noted that no early separation of soldiers and civilians in space technology is planned at this stage and that the difference is to keep the two effects.

The report states it "doubly urgent" in the report that "full coordination and integration between the Defense Department and the aerospace agency be thorough going and specifically provided for by law, not left to the chance good nature and personal inclination of the responsible officials."

The committee pointed out that the Defense Department's Advanced Research Projects Agency has previously and willingly consented to plan in space and should again do so in this regard. It added, however, that the Defense Department should be the sole arbiter of what is written and what is omitted when joint activities are ad disjecto.

The committee urged that such disputes be resolved at least at the level of the National Security Council with both the military agency and the national civilian agency being given an equal chance to be heard. "The National Aeronautics Agency must be given the right just a repository for projects of ARPA," it was interested in, the committee said.

The establishment of a national space program is a matter of the highest urgency, the committee said, both for reasons of immediate interest defense and to ensure that in the long run our space is effectively utilized for peaceful purposes.

The national space program is too important to have exclusively to military authorities or to scientists alone," the report said. "It must be conducted at the highest levels of government with other aspects of our military foreign, technological, and economic policies."

Control of the program, however, should be in civilian hands, the committee added, and oriented toward the interests of the nation.

## Four Objects Reported in Sputnik Orbit

Washington—At least four separate objects are reported to be in the Sputnik III orbit by U.S. observers. The objects are:

- **Intermediate satellite.**
- **Foil stage rocket engine.**
- **Nose cone.**

One possible more, lightweight bodies with a minimum area of several square feet, are reported.

Russian announcements have confirmed the existence of three bodies which thus have termed "Sputnik," with one an explosion of their parent.

U.S. sources in Florida, California and Texas reported independently one week ago that at least one object, which was highly visible and had about the same luminosity as a star of the seventh magnitude, was following the Sputnik III instrument carrier.

Other Russian information concerning the new celestial objects check well with data being gathered by U.S. agencies. Moscow reported that its sputnik, a 1,160-kg., its program a 150 km. high weight of its instrument carrier is 920. In its broadcast carrier is a 65 dog and the print of a robot a 100 cm.

A spokesman for the Smithsonian Institution Astrophysical Observatory in Cambridge, Mass., said all of these figures are very close to the first estimates made by his organization.

He added that the final stage rocket when it appeared over Boston at about 700 m. altitude had the brightness of

Jupiter and was approximately the same size as the final stage rocket of Sputnik II. The rocket was handling, non explosive nothing over seven seconds. It was estimated that the rocket would be preceding the instrument carrier in full orbit by the end of last week.

The Soviet news agency which reported the first three objects are of Sputnik II was beyond 7,000 km. and 3,000 km. is an excellent estimate made by the total weight in the Sputnik III rocket is around 1,000 kg.

This information checks with U.S. sources, who believe that the same rocket motor was used to launch both Sputnik II and III into orbit through the period of the latter's flight in around 1,000 kg. greater (See p. 90).

Slow performance for the first time, due frequent and sometimes brief contacts between the Russian satellites and the smaller U.S. vehicles Soviet Photo-Nauts, Kosmos, for instance, called the U.S. Explorer and Vanguard satellites "orange" and said that some "orange" would be secured to the nose of one Sputnik III.

Russian scientists made a large number of statements regarding their new satellite. One reference to an improved means of regulating the orbital parameters of the satellite is to do with a nose cone which is similar to the one Alexander N. Nesvinov, in which he emphasized that Laila, the dog in Sputnik II, died from heat prostration. This also may mean that the communication in the satellite malfunctioned because

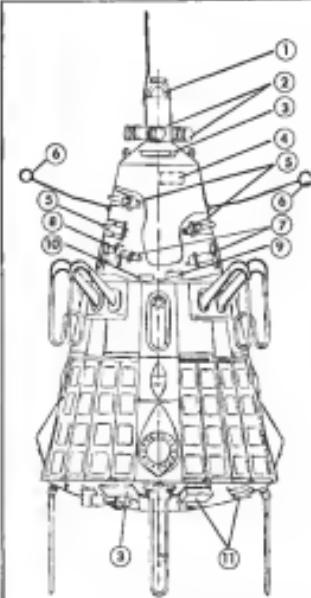
of the excessive temperature rise.

Tau, the Soviet news agency, reported that Sputnik III has a thermo regulator system which causes the short temperature inside the satellite and is a great improvement over the system in the first two Russian satellites. The operation of the system is described as depending on the controlled circulation of air inside the instrument carrier and changing coefficient of surface radiation through an internal heating and certain regulate sections of automatic regulating blinds installed on the outer surface.

The description of the instruments tau in Sputnik III, which Tau has disclosed a laboratory, in space, does not seem to be an exaggeration. It includes most of the equipment programmed for the Vanguard program. Power is supplied by chemical and solar sources, but the Russians have not indicated which instruments are of any degree completely upon the chemical batteries and is a great improvement over the system in the first two Russian satellites. The operation of the system is described as depending on the controlled circulation of air inside the instrument carrier and changing coefficient of surface radiation through an internal heating and certain regulate sections of automatic regulating blinds installed on the outer surface.

• **Coarse star orientation.**  
• **Temperature monitoring device.**  
• **Passive transients.**  
• **Radio beacon for tracking purposes.**  
This collection of instruments is controlled by a program timer that switches them on and off in precise sequence so that their measurements can be precisely related to the satellite's position. The Russians describe their much claimed telecentering equipment as an improvement over their previous equipment.

The system of optical tracking used for Sputnik III is similar to and used during observations of Sputnik II. It makes use of electro-optical cameras and provides better photographic prints than are available with the best optical equipment.



SPUTNIK III components include (1) capsule to survive gravity (2) photo multiplier to measure atmospheric resistance of sun (3) solar battery at top and bottom (4) device to register pressure in atmosphere (5) magnetic field indicator (6) static trap (7) electronic thermometer (8) magnetometer (9) apparent to register thermal inertia effect in cosmic rays (10) device to measure intensity of primary cosmic radiation and (11) sunspot surface monitor. Photo and drawing supplied by Pravda.





### CL-28s Delivered to Canada's Maritime Air Command

Canadian Maritime Air Command, Royal Canadian Air Force, officially received the Canadian CL-28 Agave anti-submarine aircraft at a ceremony at Greenwood, Nova Scotia, on RCAF Station. Five CL-28s were present for the ceremony. Ten of the aircraft have been delivered to date. Chief of the Air Staff, Gen. Michael Hugh L. Campbell officially presented the first aircraft to An Commodore Martin Corlett, as officer commanding the Maritime Air Command. The CL-28 will replace Lockheed PTV Neptunes now used at Greenwood.

### West Germany to Buy Fiat G.91 Fighters

**Boss, Germany-West** Captain un-  
veiled his Fiat G.91 fighter/trainer  
fighter from Italy.

The G.91 was a five-plane NADC cooperation test team and has been recommended by NATO for procurement in West European air forces. A flight school aircraft also has been designated a pilot project in the southwest, forward German Helmut French armament pool. But whether the French who fielded four of the five aircraft in last year's trials, would agree to an advanced version is an open question.

In view of West Germany's pilot shortage, it seems likely that the Luftwaffe will want an advanced design of the G.91 rather than the current model. A photo reconnaissance version of the G.91 also is under consideration.

### Sud Builds Monoplane For Colonial Service

Paris—First flight of Sud Aviation's twin-turboprop colonial support plane, the Vigilant, is expected to take place "before" at this month.

Aircraft is powered by two Turbomeca Astazou engines of 650 hp each.

A two-seater, the Vigilant is being developed under special French civil stat requirements which already have produced such prototypes as Messier-Batignolles' Epsilon and SIAI's 1100. The project is planned for an initial flight in the fourth quarter of this year. The Vigilant is to be powered by two Pratt & Whitney R-1740-650 hp engines (NW May 19, p. 71).

Sud Aviation's entry into the colonial aircraft competition is a monoplane, with low wing and conventional tricycle gear. Wing span is about 60 ft, length about 41 ft.

Cruising speed of the Vigilant will be just under 500 mph. Company says a civil version of the aircraft will carry about seven passengers.



### French Epernier Makes First Flight

Monsieur Soulier 2180 Epernier two-seat colonial fighter plane has made its first flight at Bourges Test Center. Designated Sperrlekrone, aircraft is powered by 800 hp Turbomeca Marboré turboprop engine, second prototype will have Turbomeca Rotax 700 hp turboprop using Pratt & Whitney propeller. Epernier can take off at 400 ft., cruise at 200 mph. Maximum range is 100 mi. Aircraft weight 3,000 lb. empty, gross weight of 6,000 lb., can carry two Nord 5-1E or Imperial missiles (NW April 14, p. 35).

## FCC Action Threatens to Delay Use of New Doppler Navigators

By Philip J. Elson

Washington—Recent Federal Communications Commission action on authorizing certain frequency bands for new navigational use, which has been put off until after FCC's new Doppler anti-interference action, may already affect other plans. Broadcasters have done strong protests from stations and a number of audio manufacturers, both here and abroad.

FCC action also may be holding the design of an air traffic controller system in Berlin, India.

Petitions urging FCC to reconsider have been filed by Amherstburg Airline Inc. (Amelia), Air Transport Asia, Bee Dog, Collins Radio, Radio Corp. of America and Douglas Aircraft Co.

Timing of FCC actions is reducing the 5,900 to 6,000 mc band from 9,500 to 9,000 mc, and 410 to 410 mc from 4,500 to 4,000 mc. In particular, the width of the 4,000 mc band is being narrowed to two Pratt & Whitney R-1740-650 hp engines (NW May 19, p. 71).

The U.S. might then be morally obliged to strengthen its own interference protection, but the facts remain the right of each country to

continue to use the Atlantic City Radio Trials of 1947 to limit the U.S. in areas—which affect 3,000 to 9,000 mc for planned military assignments.

Commissioners say that pending decision would require immediate U.S. action without waiting for the next biennial Radio Conference scheduled to be held in Geneva in July, 1958, at which time participating countries will propose detailed measures to prevent frequency allocation.

### Moral Obligation

If the 1959 Geneva conference should fail to accept a U.S. proposal to end international interference inwards FCC allocations for radio navigation, and that period there are 3,800 mc.

Douglas works in England to this point. The U.S. might then be morally obliged to strengthen its own interference protection, but the facts remain the right of each country to

use a spectrum within national boundaries for defense purposes as it sees fit. State Department hopes to obtain an extension of international interference rules if FCC changes prior to regular meeting offered U.S. position for the Geneva conference.

This will be accomplished at an International Civil Aviation Organization meeting in Montreal in August, where the subject will be a hot agenda item.

### Colonial Assistance

The construction action in midwest areas at 420-450 mc band for orbitals use (except for station services) before the commission-type of automatic oil tank丈 assistance meters which British Radio is developing as result of its Air Force sponsored study of the problem.

The Am-ATA petition cites information figures which suggest that station effects would be greatly reduced if it made possible in higher frequency bands of 1,600 to 4,000 mc.

Office of Defense Mobilization is encouraging agencies through which all government agencies deal with the FCC on frequency effectiveness matters, says neither U.S. nor FCC was aware of the

## G.E. Forms Transport Engine Unit

New York—General Electric Co. has created a new commercial jet engine organization within the framework of its Aircraft Gas Turbine Division at Eversole, Ohio. Neil Rogers, formerly project director on the JT3D turboprop development, will head the new group.

Initially, the commercial engine organization will handle marketing, field service and flight test aspects of the G.E. airline side program, but eventually it will expand to cover engineering of new developments, manufacturing, sales and service. Headquarters will remain in Eversole.

The commercial engine operation will include the JT3D turboprop, the turboshaft engine development and a new family of engines aimed at supersonic cruise performance. It also will initially offer aftershaft using the JT3B turboprop or the Convair 580 transport or overheat issues at Eversole. G.E. feels that some airline will eventually want to set up its own overheat facility, but is offering the Eversole facilities that have no military overheat on the JT3D, JT3B and JT3C engines to help the gap until the airline establishes these own facilities as possible pool overheat equipment for a number of small engines that do not want to establish their own overheat devices.

The company has authorized test power Doppler radar source at 5,000 mc per unit moved to a transponder built to reflect the same signal. Radar source "not" but contractors do not know what they are. G.E. says a handful of transponders that can be expected from (final) radar positioning devices.

Although some airline and equipment manufacturers probably say they are not too worried about interference problems, they are not willing to invest funds in Doppler systems designed for 5,000 mc if they can be rendered obsolete on short notice, says FCC.

Arbitrus points out that FCC action is contrary to international standards and a spectrum within national boundaries for defense purposes as it sees fit. State Department hopes to obtain an extension of international interference rules if FCC changes prior to regular meeting offered U.S. position for the Geneva conference.

This will be accomplished at an International Civil Aviation Organization meeting in Montreal in August, where the subject will be a hot agenda item.



### Amphibious Turbine-Powered S-62 Makes First Flight

First flight phase of Sikorsky's new 30-12 passenger S-62 shows amphibious helicopter prototype coming in for a water landing in its specially designed flying boat hull which adds less weight than use of conventional flotation gear. Powered by a single General Electric T58 engine, economy-finned S-62 will have a gross weight of 7,300 lb., useful load of 2,912 lb. Cruise speed is reported as 135 mph. Initial flight took place less than a year from date design was made. In start design work, much time was saved because S-62 uses same of proven powered 8.9% power components, such as main and tail rotor heads and blades, main, intermediate and tail gear boxes, shafting and major portions of control and hydraulic systems. Sikorsky notes that current options of commercial and military S-60s could now flew ship in less weight to even advanced configuration at considerable savings in cost. Formal rollout was last week.

Budapest program spectrum needs at the time the resolution decision was made.

In some way, the present conflict is reminiscent of the earlier Trans-DME controversy. Some airline representatives feel the industry is being highly taxed in its demands because of security, air lanes and equipment requirements for banding and tracking about the nature of military needs and the possible types of interference that may be imposed if Doppler systems operate in S-MR wave bands.

#### Warnings of Problems

However, an Office of Defense Mathematics spokesman says that no low and unique considerations" representation was attended the December meeting of the government's Interagency Radio Advisory Committee (IRAC) were warned that an intertier use problem existed in the 8,500 use band and that the civil Doppler system should be shifted to another frequency. Despite this warning, Arne decided in proceed with 8,500 as designation, the DOD spokesman said.

An Arne memo dated Dec. 17 to members of the Air Force Electronic Intelligence Command reporting on the flight to IRAC said: "We are advised that Doppler radio transmissions from military ground stations cause interference to civil narrow band radars." Because of the narrow band nature,

if interference did occur, while an aircraft was passing over a high power

station, it would intercept sufficient signals, Arne concluded.

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### Lockheed Says F-104 Can Set New Record

Los Angeles—USAF's Lockheed F-104 exceeded 1,900 mph. in its record run for the 1,644.99 mph. record set by the USAF's McDonnell F-4D. Lockheed claims the aircraft can exceed the record by a new try in approved F-104 can exceed 1,900 mph without much difficulty. Perhaps that is unlikely since speed runs are difficults of flying within tight altitude limits imposed by the Federation Aeronautique Internationale of high performance aircraft.

Capt. Wilbur W. Irvin of MacDill AFB, Fla., the General Electric 129-powered Starfighter from USAF Plant 42 at Palmdale, Calif., in an officially recorded speed run over state Edwards AFB, breaking the old record of 1,237.6 mph by nearly 200 mph. The two-second run was set by USAF Capt. Dennis T. Hines, Voodoo fighter.

Capt. Irvin is a member of the 47th Fighter-Interceptor Squadron, USAF's first operational Mach 2 squadron. The squadron is the first to hold both the world's speed and altitude records. Last week, the squadron's operations officer, Maj. Donald G. Johnson, surpassed the world's altitude record for the United States when he flew an F-4D to 91,249 ft.—more than 2 mi. higher than the previous record.

The record run record Irvin says came without benefit of unusually favorable conditions which yield greater thrust. Because of the tight restrictions imposed by the National Aerospace Act on record speed flights, my entire concentration was on holding an exact altitude over straight course 10 mi. long. He held the F-104 in a low flat, 1% climb, upward or downward over the extremely narrow course.

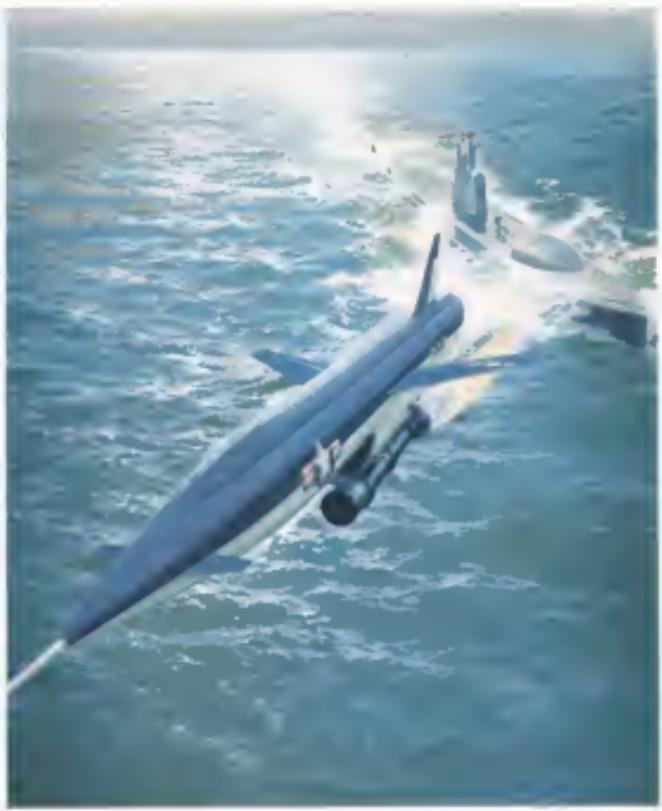
String off, free, Irvin, Irvin climbed to 40,000 ft., over Edwards, Calif., was, because Los Angeles and Edwards, and headed outward, at allowing him the maximum course. After completing the record run, he landed in a paved taxi area. Vortexes and wake, he had over the measured course to the opposite direction to cancel wind effects. The aircraft was checked at 1,639.47 mph, and he was given credit at 1,647.97 mph. Total time in the air was approximately 20 mins. The two-speed run lasted about 25 sec.

A 14-man National Aerospace Air team headed by Bertrand Rhoen, senior



**MASS RETALIATION** — USAF-Northrop SR-71 Blackbird, world's first and only supersonic intercontinental guided missile, can reach any robbery target on earth from U.S. bases. No human crew is carried and no defensive strategy yet conceived can stop the Blackbird or man's sleek! With deadly accuracy their hydrogen warheads can annihilate an aggressor's defenses. Its aerobatic maneuverability, fast, they can open paths across an enemy's homelands for the crews of our armed bombers to follow, to attack, and return. Today, Blackbirds are being delivered to our Strategic Air Command, comprising SAC's powerful striking force. The Blackbird is fully developed intercontinental guided missile—in limited production. It costs about a fraction of what any other intercontinental weapon under present test or development. America and the free nations of the world need the full defensive and retaliatory power of the Blackbird and they need it now.





**CHANCE VUGHT'S Regular R supersonic missile for the U.S. Navy uses essential Hamilton Standard equipment. This installation is another example of Hamilton Standard's leadership in the design and production of equipment, propellers, or electronic components for more than 50 mission types of turbine or rocket powered aircraft and missiles.**



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**Two J85s Power UTX Prototype**

North American's prototype UTX-1000 has passenger utility jet transport power by two General Electric J85 turbines installed out of swept wings that fold flat for work. Engines produce about 3,800 lb thrust each. Wings have six slats on each wing, shown in drop position above. Nose cone is VME retractable.

NASA West Coast representatives followed the flight with precision tracking and infrared cameras mounted on a Cessna 172. The aircraft reached a peak altitude of 13,330 feet at about 40,000 ft for visual observation to ensure compliance with the stringent requirements of the 46 nations International Transonic Association. NASA serves as U.S. member of the ITA for the recording of aviation records. The team presented data on each flight about four hours before certifying the record to Air Force officers.

### **Lockheed Contract Sets Labor Pattern**

Los Angeles—Labor peace in southern California's aircraft industry seemed virtually assured last week as far as new unionization efforts had signed new contracts or had contracts to be submitted to membership for approval.

General pattern followed that at its Lockheed California Division two weeks ago in that contracts provided for increases in wages, changes in seniority rules, job security, job definitions and holidays. Contracts generally were for two years with provisions for wage increases at start of second year.

Signed contracts entered with Lockheed and North American Aviation,

Inc., Douglas Aircraft Co. had contracts with no changes recommended by United Auto Workers, which held its national area of 13 Lockheed employees in vote on benefits sought in contract. Company Division of General Dynamics Corp. and agreements for Fiat Worth, San Diego division, Lockheed Georgia and Missle Systems Division had roundtable negotiations.

Contractors' Posture Division still had studies in progress but company reported a steady increase in number of employees represented by the bargaining unit and also returned to work sessions. By late last week, division worker strength stood at 34,419 of around 36,000 workers when strike ended. Negotiations were suspended but some negotiators remain.

Northrop Aviation, a aerospace firm, posted its employee wage rates which kept the company in line.

Riley Aerospace companies, represented by IAM were to vote yesterday on whether or not to authorize a strike. Negotiations were continuing, however.

Rheem Manufacturing's Success Division employees belatedly last week on whether or not to accept a company proposal patterned on the Lockheed agreement.

Negotiations were continuing at Boeing Airplane Co. in Seattle.

### **News Digest**

Fairchild F-27 number one prototype suffered some damage in off landing when plane's main landing gear is twisted while it was parked on the ramp. Major a tributed to failure to engage gear downlock, not due to a mechanical malfunction. Test program is being rescheduled to enable its prototype expected to start flying late next week.

Preliminary negotiations for purchase of Western Corp., which owned subsidiary of Werner Electric Co., by Litton Industries, Inc., have been completed. Western Corp. will receive a list of noncompetition products including telephone, and equipment from within defense industry. Gross income in 1973 was more than \$17 million.

American Airlines exceed \$2,900,000 during the first four months of 1974, a day from the \$2,900,000 earnings of the comparable 1973 period, the airline announced last week. President C. R. Smith held a stockholders meeting that traffic last year showed the growth of 6 percent and attributed that fact chiefly to the economic recession.

## Re-Entry May Balk Manned Red Satellite

New York—Russia's the Russians didn't place a man in their third earth satellite and probably because they hadn't yet been able to link the re-entry problem, Brig. Gen. Donald Fliegler, director of test resources, USAF, said at a meeting of the Wings Club here.

A 3,000-lb. satellite would be big enough to put a man in orbit, he said. In fact, Gen. Fliegler does not believe that it would take this much to do the job. Since, he said, "There is no equivalent of AVIATION Week in Russia, we don't know who they didn't. But we do know of a number of particular problems that could be the reason."

Among the obstacles to manned space flight, apparently still unnoticed by either Russia or the United States, Gen. Fliegler mentioned the following:

- Recovery problem fails to be solved. If he had to go out, for which position does the present system from putting man inside their third satellite, Gen. Fliegler said this would be it.

When the space capsule lands in the visible atmosphere, it will run into the combined problems of high deceleration forces and heat of reentry. The pure ballistic approach to reentry, which requires no pilot control, will probably be the quickest method attainable. But present ballistic reentry vehicles designed for the Japanese, Asian, and Pacific, will not be adequate for manned reentry. Gen. Fliegler said, "In fact, he said, as men become more heating problems, the heat shield, the difficulties of controlling the reentry angle to prevent build up of high G loads."

- Reliability of the system itself is still too low.

- Means of escape for the human passenger while he is still on the launch pad. Many rocket accidents occur during the first 10% of the missile launch phase; he demanded his insistence.

- Escape mechanism that will automatically open the passenger in case of trouble during the boost phase. After the boost phase, the acceleration would be too high to prevent any possibility of the passenger himself being thrown into orbit.

- Protection of the crew against a bad environment and with de-training the effects of weightlessness.

Gen. Fliegler gave as an example a gunpowder system with slow fuse and the like which work fine in the laboratory, but which won't work at present in an aerial space capsule. A complete replacement system will be needed. This will be correspondingly heavier and the amount of weight that can be



**Army Claims Re-Entry Success**

Army says first test site (KBM) space capsule maintained the atmosphere and was recovered intact after the later firing of the missile from the USAF Minitac Test Center, Cape Canaveral, Fla. The nose cone inserted 1,600 m above range and landed in its prescribed impact area. Recovery of the nose cone was effected through a Cook Recovery Laboratories system which showed its descent into the ocean with a parachute and then kept it afloat with a flotation cage; the search party lowered in a rubber boat and found the nose cone. The system also dropped a small explosive charge at the impact point. The charge exploded at a great depth, and its signal was picked up at three hours distance. The nose cone position was determined by triangulation. The system which was used by Coast Guard in 1953 has since been developed.

put in the space capsule with the proper control circuit.

More precise trajectory control is needed to insure a modest orbital orbit, probably one staying in altitude no more than from 100 to 150 mi. Among other things, this will permit recovery with a minimum weight of retro-rockets.

Tracking of and communication with

the space capsule will be required and still prove a considerable problem.

Similarly, technical recoveries must

## Airlines Split on No-Show Control Plan

American battles to have no-show plan dropped; Eastern, National, Northeast ask for continuance.

By L. L. Doty

Washington—Airline industry is split over the effectiveness and need for a no-show control plan, with American Airlines leading the opposition to the plan.

In a compromise move following American's opposition to the plan, the industry's other three main airlines at an Air Traffic Conference meeting in downtown the \$3 million penalty plan Aug. 12 (AVW May 19, p. 48).

Minimum time limit (MTL) in ticket pickup and the compensation rates were extended to Dec. 1. However, each of these phases of the three-month plan is likely to be水ered down in the face of American opposition when the Air Traffic Conference meets again Saturday to consider the no-show problem further.

During the local service hearings, Mohawk opposed each of the compromise plan because it had the most severe consequences in its impact on the no-show problem.

As a result, Mohawk will be exempt from all portions of the plan on Aug. 12. All others who will be except from the plan on the Detroit-Eye route where it is competitive with Mohawk.

### Sharp Split

The final result of the bitter disagreement on the issue will be an even sharper split within the industry between National and Northeast on one side and Mohawk and the rest on the other. The New York-based airline, which has the largest no-show rate, has dropped its opposition. Possibly the latest action will prompt the Civil Aeronautics Board to implement a less flexible ruling than the present plan is also of deep concern to more than one carrier.

The June Air Traffic Conference meeting, at which the compromise plan was adopted, was, in effect, an extension of the April meeting when American started ATC members by openly declaring its opposition to the plan. It was a complete reversal of position for American which was the original proponent of the plan and divided much time and energy in initially selling the idea to other carriers.

Following American's announcement at the April meeting, the conference agreed to reconvene until the May session

to about 50% of the cost of the entire plan.

Eastern opposed the penalty initially at the spring 1957 Air Traffic Conference but supported minimum fare limit and reparation. Nevertheless, Eastern and the industry later compromised on the fare increase program and the penalty clause was adopted.

### Significant Feature

Most carriers agree that American's strong "position" stand on the issue was a significant factor in the final adoption of the overall plan. March of carriers originally supported both MTL and no-compensation, but MTL coupled with the penalty drew the support of both a majority of carriers.

Fair penalty status was ample created in 1946, but failed because of noncompliance in a number of airlines. A penalty on road travel was adopted in 1954 but survived for only a few months after a number of noncomplying carriers.

American and its detractors oppose the overall plan based on the central premise that it has adverse effects on the traveling public.

### Essential

Anderson's plan would eliminate the greater class and place the burden of double checking refunds from the airline rather than on the passenger.

Furthermore, American would modify the minimum time limit on ticket package to exclude tickets issued in nothing areas or areas who could be asked to purchase tickets at minimum fares. Also, all the airfares decided that no action would be taken on the short-term fares.

The carrier said that those actions will help to make the new plan more acceptable to the traveling public.

Anderson's plan had been proposed during a period when load factors were extremely high. The plan was effective according to the airline, in gathering seats for passengers who needed them when space was frequently tight.

However, in September when the third phase of penalty provision of the plan was introduced, load factors have dropped substantially while available capacities have continued to climb. As a result, the industry is not faced with the unusual load shortage that existed up to mid-1957.

Eastern agreed that, if an adjustment to the program were to be made,

the penalty plan should be discontinued once the plan is fully implemented.

American was pressed to adopt its own plan in the event the industry failed to return the plan to the ATC meeting.

Anderson, in turn, refused to prepare a thorough analytical presentation either for or against the plan.

American Airlines was pressed to adopt its own no-show plan in the event the industry failed to return the plan to the ATC meeting.

Anderson's plan illustrates the carrier's basic objection to the central program and applies to the basic principles of the no-show problem.

Essentially, Anderson's plan would eliminate the greater class and place the burden of double checking refunds from the airline rather than on the passenger.

Furthermore, American would modify the minimum time limit on ticket package to exclude tickets issued in nothing areas or areas who could be asked to purchase tickets at minimum fares.

The carrier said that those actions will help to make the new plan more acceptable to the traveling public.

Anderson also proposed a 3.8% decrease in the average length of consecutive telephone calls since the plan was adopted as evidence that it was not lagging down reservations procedures.

ATC said it was unnecessary to increase personnel at ticket counters in order to handle the three-phase program.

in revenues as a result of the plan, a net gain for 1978 of \$3,210,000.

Loring Air Transport, Inc., a charter air-service carrier, has filed the first phase of the plan with the Office of Management and Budget. MATS' power of obligation would remain at 60% as of April 1978, in all classes of travel, including head passengers and an air and surface connecting service.

In savings taken by the ATA, 22% of fare classifications were added by the service in January and 30% were revised in April.

## House Votes Funds For Traffic Control

Washington—Parity congressional action to meet the transportation problem of air traffic control was highlighted last week in House passage of fiscal 1978 budget for the Civil Aeronautics Administration, Civil Aeromonies Board and the Aviation Modernization Board. The bill will now before a Senate appropriations subcommittee.

The House vote came after the Senate had approved the bill on a premise of increased funding for air safety. In supporting the proposal, the committee said it recognizes the urgent need for improved control of air traffic, both on and off the network. Committee said it also supports and recommends if we are to move forward at a pace which will ensure the safety of even pilot and air traffic.

The continuing speed and活力 of aviation, jet aircraft as well as the arrival of the age of commercial air transportation, present a challenge which the Congress has met and will continue to meet squarely."

CAA was recommended for a budget of \$432,930,000, a reduction at \$36,750,000 from its original request. The committee proposed that \$16.5 million of that decrease be diverted to funds from Department of Defense funds to combat areas with an additional grant of \$10 million under Viasat regulations with the military.

Congress was expressed over CAA's price limitation of end-of-year upper grade positions, which the committee recommended be reduced to 10 in keeping with a staff that will work nearly 10,000 hours in 1978.

Committee members also recommended 10 higher grade positions for the CAA in a fiscal budget approach of \$46,750,000, of which \$40.7 million reflects increased airbase personnel to 100 careers. The boldest items \$318,000 for salaries and expenses over current appropriations. The committee said the Board should accelerate its study of air space control in a framework for CAA enforcement.

AMIS was recommended for a budget of \$39 million, a reduction of \$4.1 and base year in request. The committee said the budget was cut because AMIS' power of obligation would have to be curtailed to meet the original budget

targets. The recommended amount, it said, should allow AMIS to build up its research and development program for new systems for air traffic control and allow its use of some of 240 staff positions in or that of fiscal 1978.

## MATS Defends Transport Role

By Robert H. Cook

Washington—Military spokesman say "interoperability" charge leveled at the Military Air Transport Service by the Senate post a dangerous threat to MATS' role as a combat ready supporting force in the event of war.

The MATS spokesman took a firm stand on the issue in testimony before a special Senate subcommittee investigating charges that the military service has failed in its role as a combatant during the past decade to avoid 40% of its passenger and 20% of the cargo rate from non-commercial airlines. Both scheduled and unscheduled carriers have charged that MATS' exemption is a serious lesson behind filling missions on civilian passenger and cargo operations.

Those certifications all usage carriers are freely held but solely largely on the basis of this claim.

In both the Senate hearing and multi-coupled testimony before a House subcommittee, Gen. Turner was charged that MATS has been guilty of the use of its fleet 1,100 aircraft, the advancement of a larger fleet of military aircraft, and the retention of surplus aircraft and the aircraft for its training mission.

Details of MATS' planned initial combat support of the Strategic Air Command were reported in Senate and House hearings in closed session.

MATS says that it will spend \$70 million that year for its commercial air transportation and expects the figure to climb to \$80 million for fiscal 1978.

An spokesman said it is attempting to comply with the congressional directives, the Senate says the FY 1978 total passenger budget. The future is 30 million passengers and 8.1 cargo. Besides required, it could have increased its appropriations for fiscal 1978, to \$120 million.

Douglas C. Shephard, Assistant Secretary of the Air Force, told the House that projected figures for fiscal 1979 show that \$54.6 million for passengers and \$50.1 million for cargo transportation by commercial carriers would be needed to fully comply with the demands of Congress.

Appearing before the Senate committee Shephard said that, while MATS must be retained on a steady alert basis the aircraft must be used to regular operations in order to fulfill part of

the Department of Defense needs. He also indicated that MATS' alert status would be accelerated in an effort to match a similar alertness rate as opposed to the present rate of four times.

Shephard also took issue with the non-military carriers who depend heavily upon military business which he said, "functions as an indispensable means of revenue."

Commenting on the role of flight equipment, Shephard said that MATS is driving this out of business. Shephard said it is not an Air Force responsibility that they brought more cargo planes. MATS has added aircraft as its full capabilities and is not responsible for the scheduling function.

Gen. Gen. William D. Rutherford, the joint chief of staff for the joint force air arm, Chief of Staff of the Air Force, in his testimony before the MATS subcommittee, Gen. Turner was in charge of the Berlin and Korean airfields as well as the "Hump" Open ports during World War II.

Some of the MATS fleet has been transferred to the Joint Chiefs of Staff as the maximum number of planes needed for the initial phase of an emergency. He said that MATS at the present strength can meet this initial need and would be supported within 48 hours by the Civil Reserve Air Fleet of 362 transport aircraft.

MATTS has ordered 50 Douglas C-133 transports to handle emergency requirements. Shephard said that an immediate decision should be made to buy 100 more.

Gen. Shephard told the Senate that the Air Force, expected between 170 and 180 and \$60 million on the large C-133, but only controlled a planned order for 10 when the Air Force moved to a total of more than \$600 million. By planning that the money was needed elsewhere, he added that the aircraft had such a large capacity that MATS could probably have not needed 18.

Committee members also questioned a projected expenditure of \$15 million for the purchase of three Boeing 707 jets which Shephard explained were needed in the cold war with the Soviets who then top officials to jet aircraft. The United States could not afford to suffer a comparison, a philosopher advised him by the Stark Department, and the Secretary.

## Third CAA Airway Plan Includes Automatic Control Provisions

Washington—Civil Aeronautics Administration, last week, issued a third federal airways plan that includes provisions for the first elements of automation of air traffic control.

As the core of the first two plans emphasis is placed on rules control to handle traffic in multiple terminal areas and high density routes. The report and plan set up the major elements which are in the integration of airline traffic and traditional air traffic.

First federal airway plan, covering fiscal years 1978-1981, was established in 1973 to demonstrate if the airports would support a total of five new routes.

The second plan reflected the original program only their costs and funds for fiscal 1978 were appropriated for that purpose.

The new plan, covering the years 1978-1981, revises the previous plan "to reflect present conditions including recent budgetary limitations."

### Proposed Steps

Here are the steps proposed by the CAA in its latest plan to increase traffic capacity of the airports:

- **Rapid dissemination of IFR/MFR**: facilities for IFR use is proposed. CAA noted this facilitates the most serious problem facing the air traffic controller today and added that utilization of the system will expand available air space and eliminate unnecessary traffic conflicts.

- **Review**: Viasat airway structure to permit greater use of express airways.

- **Stabilization**: of express to segregate high-speed and short-haul traffic and to provide for high-speed, high-volume traffic.

- **Installation**: of additional Viasat facilities in major terminal areas to provide latent separation of express and express routes.

- **Installation**: of additional Viasat facilities on high-density routes to provide multiple express services, laterally separated.

- **Additional flexibility** in the selection of radar sites, especially through the use of distance (DME) measuring techniques.

The plan calls for increased reliance on radar during the next five years in the use of new types of air traffic control displays. Flight progress panels at major airports, the control boards will be replaced by radar displays with a strengthened system that generates techniques will be used.

CAA began the establishment of automatic data processing and transfer

equipment in fiscal 1978. It identified that, under the final plan, some aspects of the overall program leading to automation may not be carried out until the latter years of the plan because of the need for more extensive development and evaluation work.

### Flight Distances

In its study of potential traffic conflicts as a basis for the third plan, the CAA concluded that air traffic "was not well fit" a short-haul business. It said that range of an en route IFR flight should easily cover all of every four IFR flights has a distance of less than 150 mi.

The report and 50% of each flight covered distances of less than 200 mi and added that the pattern during the 1978-1981 period is expected to remain about the same.

The report said that the 16.2 million domestic aircraft operations recorded during fiscal 1977 with CAA traffic control service were 5.4 million flights than the cases in fiscal 1978 for an increase of 35.7%. CAA forecast 22 million aircraft aircraft operations in 1980 and 30 million in 1985.



Convair 880 Metal Mockup

Aircraft mockup of Convair 880 jet transport aircraft completed at San Diego, Calif., will be extensively modified replicas of actual fuselage and wing of the aircraft. Mockup will include full detail on deck flight. Much of the aircraft is left open to provide access to placement of electrical wiring, taking orders and other equipment. Mockup offers engineers to work on exact placement as modifications can be made without fear of production, instead of actual aircraft. Swept-wing jet transport is scheduled to go into airline service early in 1980.

The report total attorney travel time in some respects from both passengers and the various national products but added that much growth has been limited to the private marketplace and the service. It said that despite the growing volume of surface passenger traffic, "there is still plenty of room for growth; in 1978, air traffic was 3.3% of the total airways and 31.9% of the commercial carrier industry travel market."

## CAB Lawyers Term Air Contest 'Unfair'

Washington—The Civil Aeronautics Board's Office of Complainant has informed the Federal Trade Commission that it has a complaint against the National Airlines for having violated a 1970 antitrust agreement which a new study was.

The airline is offering 200 grants to passengers who file its studies between April 1 and June 30. Kevin March update that the contest is "subject to all federal, state and local laws, regulations and orders."

Complainant attorneys contend that the contest constitutes an unfair method of competition, violating paragraph 6(b) of the Sherman Act.

Antidiing of place, they say, will be a notable part in part of the cost of the prize winner's ticket.





# PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA



## 1134 hours between majors—no repairs! in photo and rescue work where dependable power is a must

"To be successful in our business—which includes low-altitude photo flights and aerial rescue work—you need two basic requirements: a good airplane and dependable fuels and lubricants," says Al Hudgen of Hudgen Air Service, Tucson, Arizona. "That's why we use Chevron Aviation Gasoline and RPM Aviation Oil Compounds in all our planes. Here's just one example of what I mean. We get exceptional service from a Lycoming 180-hp engine in our Piper Tri-Pacer. This engine gave top performance for 1134 hours between overhauls! On inspection

passions showed no bearing or wear. Engines were completely free and clean. All oil filters were clear, too, and free of any deposits. Engine condition was such that I feel it could have flown another several hundred hours." Al Hudgen runs up his estimate this way: "We've sold off over 1000 units of Chevron/RPM Aviation Products every year, as far as we're concerned. That top condition gives us a safe safety margin against breakdowns...for safer, more economical and dependable flying. That's what keeps us in business."



Top left: piston and rod service after 1134 flying hours on RPM Aviation Oil Compound.



We take better care of your plane



## SHORTLINES

**Pan American World Airways** reports that gross operating revenues for the first quarter of 1964 were \$54,256,000 as compared with \$56,756,000 for the same period last year. Passenger revenues were down 3% to \$47,386,000 and freight revenues down less than 1% at \$7,387,000. The airline's operating expenses increased 4% over last year's first quarter for a net loss of \$3,360,000.

**Royal Air Maroc**, Morocco's airline which now uses Douglas DC-3 and DC-4 aircraft, has ordered two Sud Aviation Caravelle turboprop transports and expansion projects are under way in the meantime. In 1963, Royal Air Maroc is owned by Air France for Morocco's government and the Paquet and Piatoff shipping group.

**Finnair World Airlines** has completed closing the airports and adjacent areas at Nokia's Alanta, Tampere, St. Peterburg and Moscow for training purposes. The 10 new routes are to be used in TWA's Flight Training Center at Kansas City to familiarize and qualify pilots from the airline's St. Louis, Atlanta route. A center was suspended from a bar across the top of the cockpit of a TWA plane and reproduced a seat of honor as would be seen in the cabin of the aircraft.

**United Air Lines** has awarded a \$97,600 contract for construction of a jet engine overhauled building at San Francisco International Airport in Marin & Marin, of San Francisco. The new building will be 300 ft. x 400 ft. and 26 ft. high and is scheduled for completion in May 1965. George H. Meekle of Albert Kahn Associates is the architect. Under the long-standing traffic agreement unit four air carriers operate at the airport: Pan American, South American and Pan American, each paying pro-rata for transportation of passengers and cargo over United's routes and of the other carrier by using a ticket ticket or as needed. Addition of the fourth carrier, Aeroflot, Nigerian, Ryan Airline of Colombia, Irish Airlines and Trans Airline, brings to 118 the number of such airline agreements involving United.

**Seaboard & Western Airlines** has been authorized by Civil Aeronautics Board to carry U.S. mail between the U.S. and the seven European countries served in the airline's name. Seaboard & Western will be compensated in the amount of subsidies allocated basis in Pan American, World Airways and Trans World Airlines.

## AIRLINE OBSERVER

**► Use it or lose it** policy has been adopted by the Civil Aeronautics Board in providing local airline service. For the first time since Nebraska, South Dakota and North Dakota. Under the plan, route segments and cities, many of which will receive airline service for the first time, must capture an average of the passengers daily or lose the service. The Board will review each route after 18 months of operating experience and conduct formal proceedings to determine whether the service should be dropped if traffic is below the five passenger standard. The decision must out of the Seven States Case, the first of nine regional proceedings designed to expand local airline service to smaller communities throughout the nation.

**► Airline traffic is showing a substantial improvement this month after a seven-week period of chartering results (AW May 15, p. 62). Although the opening has been general on most major state segments, there are still certain areas—particularly in highly industrial sections—where the current economic sluggish conditions to depress normal seasonal traffic growth.**

**► Soviet airline Aeroflot has levied new revenues against Russian airport personnel. The current charge that although the quality of passenger service improved last year at some terminals, "it still isn't at a high level." At Berlin, Ul'chi and Magadan, Aeroflot said, "airport workers show indifference indifference toward passengers at ticket and Khabarovsk, transports time of returning 110 passengers to the city in poorly organized, at Kiev, Moscow and Baku, passengers had a long time for porter." East Asian Rotarax Vnukovo Airport was criticized for baggage delays.**

**► Capital Airlines** plans to install air-ground public telephones in use of its Vickers, following extensive favorable passenger reaction to similar units installed at Northeast Airlines Stratocruiser. Equipment will be provided by ATC Spark Plug Division of General Motors (AW Jan 27, p. 90).

**► Civil Aeronautics Board's revised procedures covering operational hearings will be applied for the first time when the operational phase of public hearings on the Capitol Airlines' Vickers service at Madison, Mich., opens in September, June 5. Technical phase of the hearings will be held at Wash. starting on July 5. Under the new procedures, parties to the investigation will be allowed to question witnesses orally and relayed, a procedure conducted will be held June 2 in Saginaw at which time parties to the investigation will present material supporting their questions to the presiding officer.**

**► American Airlines** sales officials are on the West Coast discussing joint sales promotion projects with Boeing and Lockheed sales people in part of American's campaign coverage the introduction of the 707 and Electra late this year.

**► Continental Air Lines** has been charged in a Negro pilot with violating Civil Rights and discrimination laws in relation to how him and regular passengers. Miles D. Green told the State Department's Civil Rights Commission he was discriminated in Continental's Denver last January and was denied employment. Continental officers denied the Commissioner's probe that challenged contributions of the law and claimed any discrimination was avoided.

**► Eastern Air Lines**' first Lockheed Electra test work made its maiden flight in a test area over the Pacific Ocean in a one hour and 16 minute run. Eastern will take delivery of this plane in September and will operate an even dozen in scheduled service by the end of the year. Luster is styled in gold, blue and navy white and is fitted with 60 seats and a lounge.

**► House Appropriations Committee** has agreed that legislation be passed on the current session of Congress to institute use charges on aircraft flying for "profit and pleasure" to cover costs of airport facilities. The committee also recommended that consideration be given to placing similar fees on Defense Department flying activities.



## BRISTOL PROTEUS

1300 hours between  
overhauls in 13 months  
airline service

In just over thirteen months of airline operation, the overhaul life of the Bristol Proteus 765 jet-prop has been extended from 500 to 1,300 hours—conclusive proof of this engine's mechanical soundness and exceptional reliability.

First axial engine on the world's international routes, the Proteus is also the first engine to feature the free-turbine system, pioneered by Bristol. This system gives flexibility in choice of power and propeller speed, produces remarkable efficiency over a wide range, and results in very low noise and vibration levels.

Proteus has the lowest specific fuel consumption of any gas turbine in service—aircraft or rail.

**Proteus powers the Britannia.** The Bristol Proteus, most powerful jet-prop in airline service, powers the giant Britannia—currently setting new standards of speed and vibration-free comfort on world-wide routes.

**Bristol's famous engines.** Proteus is only one of Bristol's famous engines. In addition, there are—

Centaurus—a lightweight, medium-thrust turbojet with an outstanding power/weight ratio. A derivative of the Orbital—the Wright YJ 25—has been jointly developed by Bristol and Curtiss Wright.

Orbital—a fully developed ramjet engine, designed for complete reliability in warning and flight

escapers—remarkable for great power at high altitude and very low fuel consumption. Bristol and Curtiss Wright have jointly developed a small version of the Olympus—the Wright T34B Zephrys.

Olympus and Hercules—solid piston engines with Bristol-pivoted sleeve valves... renowned for reliability and long overhauls.

**BRISTOL**

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400 PARK AVENUE, NY 22, NY

## Scientist Compares U.S.-Red Satellites

By S. B. Kramer

On Oct. 4, 1957, diligent and ever-expanding Russian science and engineering astonished the population of the entire world by placing an orbit about the earth, the first artificial satellite.

Sputnik I was the fruit of a concerted effort by Russian technical persons who must have a strong program comprising the nation's space and scientific aims of research and satellites. The appearance of Sputnik II and III, and preliminary indications of their use, strengthen the belief that at least in these aspects of engineering and science, Russia is well ahead of the United States. As early as December 1957, the Russian successes gave some impetus to the American program so that at this writing there are three American satellites orbiting the earth.

The early Russian success was probably due in large part to their ability to perfect propulsion systems of substantial

fuel thrust and their prior application with uninstrumented instrumentation throughout the launching vehicles and payload. In the current thoughts on the weight of Sputniks, it is reasonable, therefore, to assume loadings on 108 kg megapascals the lifetime of this unit is determined.

Explorers I and Explorer III are presented to form a certain similar report. In addition to the detailed characteristics of the original instruments, an assessment can be also drawn. To the instrumentation there was added for Explorer III an omnidirectional receiver, counter which records with a tape recorder for 180 sec and then again records ready out to record the contents of the tape.

Sputnik I according to references in the press, carried instruments operating at 20 megahertz and 40 megahertz, transmitting interrupted communications signals.

It is generally presumed to have recorded density and temperature measurements and brightness, as well.

Sputnik II carried instruments oper-

ating on this frequency stopped just before 8:30 p.m. EST on April 15, 1958. Vanguard I carried as well a solar-borne, transistorized broadcaster on 108.6 megahertz. The lifetime of this unit is determined.

Explorers I and Explorer III are presented to form a certain similar report. In addition to the detailed characteristics of the original instruments, an assessment can be also drawn. To the instrumentation there was added for Explorer III an omnidirectional receiver, counter which records with a tape recorder for 180 sec and then again records ready out to record the contents of the tape.

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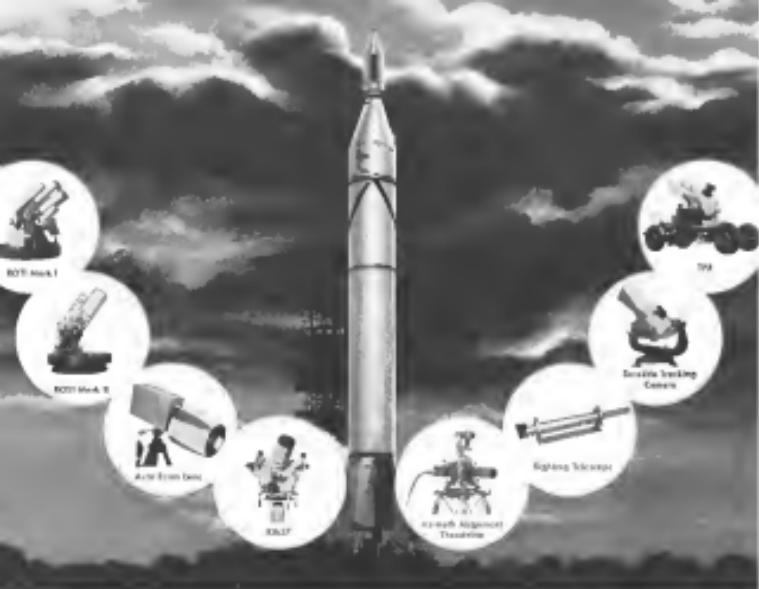
Table I—Common Parameters

PARAMETER	VANGUARD I	EXPLORER III	EXPLORER I	SPUTNIK II	SPUTNIK I	SPUTNIK I
NET dry weight launching times	1,150 lb. 10:30 A.M. EST Nov. 1, 1958	1,090 pounds 10:10 P.M. EST Mar. 16, 1958				
Launching phase						
Orbit period (min.)	112	114.67	114.67	108	108.67	108.67
Average height (km.)	2,310	2,440	2,440	2,310	2,310	2,310
Perigee height (km.)	200	217	217	215	215	215
Apogee velocity (km./sec.)	10,990	10,890	10,890	10,430	10,330	10,290
Perigee velocity (km./sec.)	27,100	29,700	29,700	26,260	26,260	26,260
Initial orbital eccentricity	0.1337	0.1337	0.1337	0.1337	0.1337	0.1337
Launch-energy ratio (E-E <sub>0</sub> )/E <sub>0</sub> (kg-sec)	1.3448	1.3448	1.3448	1.3448	1.3448	1.3448
Mass-mass ratio of satellite/E <sub>0</sub> (kg)	0.0493	0.0493	0.0493	0.0493	0.0493	0.0493
Secular rate of orbit (km.)						
a = 0.4 in.	14.8 in.	14.8 in.	14.8 in.	14.8 in.	14.8 in.	14.8 in.
length = 10 km.	11.1 in.	11.1 in.	11.1 in.	11.1 in.	11.1 in.	11.1 in.
Orbital rate of satellite	1	1.2	1.2	1.2	1.2	1.2
Instrument weight on board (lb.)	2.4	20.0	16.9	8,140	8,118	8,118
Inertias of launch						
I <sub>xx</sub> (kg) <sup>2</sup>	32,400 <sup>1</sup>	2,400 <sup>1</sup>	2,400 <sup>1</sup>	41 <sup>2</sup>	45 <sup>2</sup>	45 <sup>2</sup>
I <sub>yy</sub> (kg) <sup>2</sup>	32,400 <sup>1</sup>	2,400 <sup>1</sup>	2,400 <sup>1</sup>	45 <sup>2</sup>	45 <sup>2</sup>	45 <sup>2</sup>
I <sub>zz</sub> (kg) <sup>2</sup>	32,400 <sup>1</sup>	2,400 <sup>1</sup>	2,400 <sup>1</sup>	45 <sup>2</sup>	45 <sup>2</sup>	45 <sup>2</sup>
Total weight placed in orbit (lb.)	22,400	42,000	45,000	140,000	149,000	162,000
Initial test (lb.)	10,000	10,000	10,000	28,000	38,000	354,000
Total launching mass (lb.)	220	148	168	1,000	1,000	1,000
Lifetimes of satellites	19.7 hr.	35.4 <sup>2</sup> days	1,094 <sup>2</sup> days	830 days	745 days	745 days

<sup>1</sup> Estimated<sup>2</sup> Values assume no current publications

Table III—Comparison of Vanguard and Sputnik

	VANGUARD I	VANGUARD I	VANGUARD I	VANGUARD I
1. All-up weight	100,000 lb.	21,000 lb.	31 lb.	280 lb. (max. 300 lb. min. 250 lb.)
2. Overall length	10 ft.	2.9 ft.	3.8 ft.	376 ft. (max. 387 ft. min. 352 ft.)
3. Greatest diameter	0.1 ft.	0.1 ft.	0.1 ft.	7.500 ft. (max. 7.505 ft. min. 7.495 ft.)
4. Rocket weight	10,000 lb.	10,100 lb.	10,000 lb.	1,950 lb.
5. Total launching mass	120,000 lb.	27,000 lb. (max. 27,000 lb. min. 26,000 lb.)	31 lb.	300 lb. (max. 320 lb. min. 280 lb.)
6. Total impulse	44,000,000 lb.-sec.	8,770,000 lb.-sec.	10 sec.	4,600 lb.
7. Orbit perihelion	192 lb.	31 lb.	31 lb.	31 lb.
8. Orbit apogee	100,000 lb.	21,000 lb.	31 lb.	280 lb. (max. 300 lb. min. 250 lb.)
9. Altitude	100,000 ft.	21,000 ft.	31 ft.	376 ft. (max. 387 ft. min. 352 ft.)
10. Length	10 ft.	2.9 ft.	3.8 ft.	7.500 ft. (max. 7.505 ft. min. 7.495 ft.)
11. Mass ratio	0.10	0.10	0.10	0.10
12. Propellant weight	10,000 lb.	10,100 lb.	10,000 lb.	1,950 lb.
13. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
14. Thrust	100,000 lb.	27,000 lb.	31 lb.	300 lb. (max. 320 lb. min. 280 lb.)
15. L <sub>1</sub>	200 ft. (max. 200 ft. min. 190 ft.)	50 ft. (max. 50 ft. min. 40 ft.)	31 ft.	376 ft. (max. 387 ft. min. 352 ft.)
16. Weight established	100,000 lb.	21,000 lb.	31 lb.	280 lb. (max. 300 lb. min. 250 lb.)
	SPUTNIK I	SPUTNIK I	SPUTNIK I	SPUTNIK I
17. Alt-up weight	100,000 lb.	21,000 lb.	31 lb.	280 lb. (max. 300 lb. min. 250 lb.)
18. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
19. Length	10 ft.	44 ft.	44 ft.	44 ft.
20. Mass ratio	0.10	0.10	0.10	0.10
21. Propellant weight	10,000 lb.	10,100 lb.	10,000 lb.	1,950 lb.
22. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
23. Thrust	100,000 lb.	27,000 lb.	31 lb.	300 lb. (max. 320 lb. min. 280 lb.)
	SPUTNIK II	SPUTNIK II	SPUTNIK II	SPUTNIK II
24. Alt-up weight	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
25. Length	10 ft.	30 ft.	30 ft.	30 ft.
26. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
27. Mass ratio	0.10	0.10	0.10	0.10
28. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
29. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
30. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
31. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
32. Length	10 ft.	30 ft.	30 ft.	30 ft.
33. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
34. Mass ratio	0.10	0.10	0.10	0.10
35. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
36. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
37. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
38. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
39. Length	10 ft.	30 ft.	30 ft.	30 ft.
40. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
41. Mass ratio	0.10	0.10	0.10	0.10
42. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
43. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
44. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
45. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
46. Length	10 ft.	30 ft.	30 ft.	30 ft.
47. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
48. Mass ratio	0.10	0.10	0.10	0.10
49. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
50. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
51. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
52. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
53. Length	10 ft.	30 ft.	30 ft.	30 ft.
54. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
55. Mass ratio	0.10	0.10	0.10	0.10
56. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
57. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
58. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
59. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
60. Length	10 ft.	30 ft.	30 ft.	30 ft.
61. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
62. Mass ratio	0.10	0.10	0.10	0.10
63. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
64. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
65. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
66. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
67. Length	10 ft.	30 ft.	30 ft.	30 ft.
68. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
69. Mass ratio	0.10	0.10	0.10	0.10
70. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
71. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
72. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
73. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
74. Length	10 ft.	30 ft.	30 ft.	30 ft.
75. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
76. Mass ratio	0.10	0.10	0.10	0.10
77. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
78. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
79. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
80. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
81. Length	10 ft.	30 ft.	30 ft.	30 ft.
82. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
83. Mass ratio	0.10	0.10	0.10	0.10
84. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
85. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
86. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
87. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
88. Length	10 ft.	30 ft.	30 ft.	30 ft.
89. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
90. Mass ratio	0.10	0.10	0.10	0.10
91. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
92. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
93. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
94. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
95. Length	10 ft.	30 ft.	30 ft.	30 ft.
96. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
97. Mass ratio	0.10	0.10	0.10	0.10
98. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
99. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
100. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
101. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
102. Length	10 ft.	30 ft.	30 ft.	30 ft.
103. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
104. Mass ratio	0.10	0.10	0.10	0.10
105. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
106. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
107. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
108. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
109. Length	10 ft.	30 ft.	30 ft.	30 ft.
110. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
111. Mass ratio	0.10	0.10	0.10	0.10
112. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
113. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
114. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
115. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
116. Length	10 ft.	30 ft.	30 ft.	30 ft.
117. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
118. Mass ratio	0.10	0.10	0.10	0.10
119. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
120. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
121. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
122. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
123. Length	10 ft.	30 ft.	30 ft.	30 ft.
124. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
125. Mass ratio	0.10	0.10	0.10	0.10
126. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
127. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
128. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
129. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
130. Length	10 ft.	30 ft.	30 ft.	30 ft.
131. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
132. Mass ratio	0.10	0.10	0.10	0.10
133. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
134. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
135. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
136. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
137. Length	10 ft.	30 ft.	30 ft.	30 ft.
138. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
139. Mass ratio	0.10	0.10	0.10	0.10
140. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
141. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.
142. Thrust	70 lb.	70 lb.	70 lb.	70 lb.
143. Weight established	700 lb.	300 lb.	300 lb.	300 lb. (max. 300 lb. min. 250 lb.)
144. Length	10 ft.	30 ft.	30 ft.	30 ft.
145. Diameter	0.1 ft.	0.1 ft.	0.1 ft.	0.1 ft.
146. Mass ratio	0.10	0.10	0.10	0.10
147. Propellant weight	70 lb.	70 lb.	70 lb.	70 lb.
148. Propellant specific impulse	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.	2.5 ft-lb/lb-sec.



## P-E optical range instrumentation provides vital missile data

checks behavior from production through flight

Engineers must see what is happening to a missile at every stage of its life. And Perkin-Elmer optical range instruments help them see...on the production line, in the laboratory, far from the P-E laboratory, at the launching site where P-E instruments first fit the missile for flight and then record vital data about its speed...downrange where P-E tracking instruments let observers watch—and learn from—it in motion—across the globe.

**ROT Standard Optical Ranging Instrument Model 1**—This telescope emerged with remarkable range and visual clarity in the field of scientific instruments.

**ROT Model B**—Standard rangefinder and camera with rotatable mirror records for tracking objects that pass behind fixed or other obstructions.

**PER Opticron Photographic Recorder**—A photographic recorder in function to ROT-1, but designed for easy mobility to any site accessible to prime movers.

**ROT-Dyn-Ranging**—Intermediate range measurement and evaluation of AA fire, anti-aircraft gunnery, etc.

**ROT-Accelerometers**—Short, intermediate and long range models—a permanent guidance system at assembly

and at the missile launching site.

**Ranging Telescopes**—Complete, wide field of view, high magnification for quick target acquisition.

**ROT-Accelerometer Recording Camera**—Uniquely P-E designed optical system, high lighting-gathering power, wide field of view, will enable users to photograph 100% of vehicles.

**ROT-Dyn-Instrument**—Extremely versatile and certain of standard closed circuit TV cameras. Provides smoothly synchronized wide-angle or close-up observation of target, target or instruments.

An interesting booklet, "Optical Telemetry," gives more information than all other P-E instruments for the Space Age may fully. Write for it.

ENGINEERING AND OFFICIAL DIVISION  
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pective lifetimes of these satellites as those of 1 and 1/2 years the number of revolutions obtained from the figure.

The inevitable question of course after examination of data and exploration of published publication is: How do the satellites compare? This has been as absurd and unscientific as to compare tall of loaded specimen and loaded animals according to the inclination of the investigator!

### Table III

In Table III the comparison is placed of some of these policies. The moderate Vanguard attitude clearly has won over the Soviet one. The urban group for Sputnik should be viewed as a minor blip, and no explanation is demanded that they are suborbital. Since they were presented at a meeting of the American Astronautical Society in October 1957, many extra data on the Sputnik 1 data have appeared in the press.

The article from Russia via Gagarin Brown and every publication in the United States lead to the belief that extreme comparison that this set of calculations—these speed discrepancies are the most direct that one can make of revolution time for Sputnik.

Mr. British Interplanetary Society Journal Space Flight published in

the British Interplanetary Society Journal Space Flight published in

Table II—Explorer I Instrumentation\*

	Low-Power Instrumentation	High-Power Transmitter	
Transmitter power	10 watt	500 watt	
Transmitter frequency	104.4 mc	140.7 mc	
Antenna type	Biplane	Terradip	
Maximum effective antenna gain	-2 db	+7 db	
Maximum effective radiated power	1.4 dBm	+18 dBm	
Orbiting polarization	None	Circular	
Type of modulation	Pulse	Amplitude	
Amount of modulation (duty cycle, %)	0.7 millisecond	50 microsecond	
Solenoid frequency	1000 cps	100 cps	
FM channel	3, 3, 4, 8	5, 6, 7, 9	
Measurement by channel equipment			
Channel 3 (200 cps)	Skin temperature, heat shield	Skin temperature, heat shield	
Channel 2 (200 cps)	Mass crew temperature heat shield	External temperature heat shield	
Channel 3 (400 cps)	Mass crew temperature heat shield	External temperature heat shield	
Elapsed life	2 months	2 weeks	
Standard Accelerometer Channel Assignment for PRM-10 Telemetry			
Channel No.	Low-Band Unit	High-Band Unit	Total Bandwidth (cps)
1	010	001	84
2	010	001	84
3	010	001	100
4	001	001	100
5	001	001	100

\* From April issue of Aviation Week

## NEW LEONARD FORCE BALANCE ACCELEROMETERS WILL REDUCE FLIGHT TEST TELEMETERING AND RECORDING ERRORS UP TO 100 TIMES

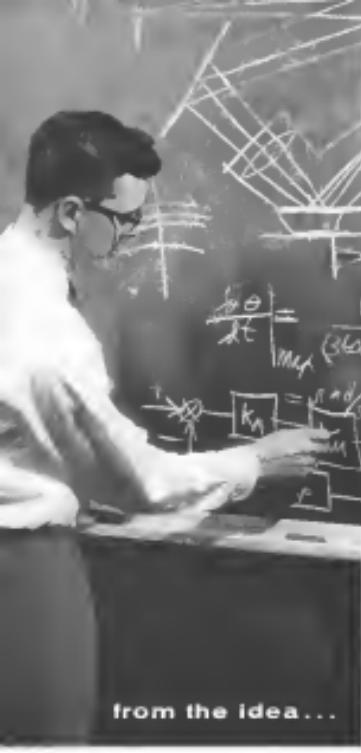
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for. We'd like to tell you more about them—and about how the military and industry use them in projects which require creative thinking and painstaking accuracy.

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**MECHANICAL DIVISION**

Intelligent Engineering and Precision Manufacturing



January 1958, information received  
from Messerschmitt-Bölkow-Blohm

Among the data so published were  
figures of 264,000 lb. for the first-stage  
boost (4,930 mph, 6,669 ft./sec.) first  
stage burnout velocity, 79,000 lb. for the  
second stage (burnout, 12,000 mph  
(17,200 ft./sec.); second stage  
burnout velocity).

#### Weight Estimates

From data in this journal on the  
third-level and layout velocities for the  
Spartan trajectory applicable to the  
154 lb. payload configuration, the following  
weights were estimated:

Initial lift-off	176,000 lb.
Booster propellant	116,000 lb.
First stage burnout	58,000 lb.
Second stage boost	51,230 lb.
Booster propellant	36,000 lb.
Second stage burnout	18,514 lb.
Third stage boost	9,934 lb.
Booster propellant	5,534 lb.
Third stage burnout	4,000 lb.
Fourth weight	1,476 lb.
Final weight	2,124 lb.

Such a configuration would call for an  
ICBM requirement for a ballistic range  
of 5,500 miles if the third stage is  
removed and a payload added. If the  
Spartan I vehicle comprised two booster  
stages and a solid-propellant final stage  
it is reasonable to assume that the pay-  
load would be limited to approximately  
154 lb.

Spartan II would have required a  
complete third stage, under those or  
circumstances performance limitations  
would have restricted the payload to the  
1,120 lb. actually reported. With an  
assumption that the payload can still  
go to the 154 lb. shown but not includ-  
ing the increased fuel weight that must  
go into orbit with the payload.

If the Russian state of the art with  
respect to performance is lower than  
ours the effect on these estimated data  
is simply to increase the overall launch  
weight without changing the final pay-  
load weight. If, on the other hand, their  
performance before the initial lift  
off weight can be less. Again the pay-  
load remains the same.

#### Other Alternatives

The other alternatives are that the  
Russian state of the art with respect  
to performance is greater in terms of  
lift-off than the present state here. Some  
change would therefore be required in  
the maximum payload shown.

An interpretation of the latest levels  
as noted leads to a possible conclusion  
that the Russian ICBM performance  
level is slightly below our own, thus  
that could indicate an initial launch weight  
for Spartan III higher than that shown

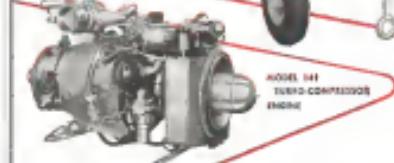
AVIATION WEEK, May 26, 1958

## NOW IN VOLUME PRODUCTION ... the TC-106

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Typical of the fine results of Continental development is  
the TC-106 portable starting unit for large jet aircraft. This  
advanced new model, with a high performance turbo-diesel  
engine as its heart, weighs one-third less than its  
predecessor, yet has 17 per cent higher output, and in  
addition, offers improved qualities: greater availability, less  
noise, and a completely automatic control system. . . . It  
is now in volume production at the Continental Aviation  
and Engineering Toledo plant.

C.A.E. gas turbine models—the 340-T-5, the 340-T-12, and the 400-T-12A—are being built by the Spartan F-104A, 1000 jet trainer, Boeing's 707, Boeing 720, the Boeing 747 Intercontinental, and the Ryan  
QR-2 Fire Fox target drone.



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Another in a series on commercial aircraft operations... and why these operators, like the major airlines, prefer Champion Spark Plugs. Noted aviation authority reports on Allied Helicopter Service...

## Uncommon Endurance

By HERB PISHER—International aviation authority, veteran pilot, author

"Surveying... Flying machinery... breaking winds to hell, thin heights..."

The romance of the whirlybird is a dead duck so far as Allied Helicopter Service is concerned. Allied works in unglamorous oil—mainly.

Headquartered at Tulsa, this unusual eight-year-old "rugged-duty outfit" is known on a world-wide basis—surveying, exploring, paving, paving, surveying, building... frequently under contract to the government, to states, to cities, to Alaska.

As Roy B. Davis, Allied's President, told me: "For sure, it's all work. Far more work, it's just plain hell."

A colorful Oklahoma attorney whose work in corporate law led him to the financing of Allied, David spends with undisguised admiration for his toiling helicesters:

"These are no doddle-up-guitar birds. We tell them down here in our shop—admitting to engine—down to the nuts and bolts. We can't afford them from the insurance. We've had one accident. We don't care how pretty they are. They've just got to be tough, beat up to hell—stand specific punishment."

"No engine goes in service until we've

made it precision-perfect—this to take about incredible overwork despite strenuous and honest, arduous weather and hot, then altitude. That's why Champion Spark Plugs are so vitally important to us. The heavy dependency of a good engine. Without 100% dependable engine, you can wash out a short order in an operational good fit day."

### SPRAYING SPRINKLING

Allied's main operation shows crop-and-pasture spraying—herbicides for pastures, broads, fertilizers, right-of-way, orchards and ditch banks, insecticides on croplands. Fertilizers, etc.—crop spraying of broadcast scope, jet, fan, fan/nozzles, ground banks.

On the far going front, Allied is spraying 30,000 acres of bananas per month to Guatemalan river-bottoms. Eight "open cockpit" pilot and mechanic crews are on the job. This operation represents a borderline—it's a year crop savings to banana growers, David said.

Roughly speaking, for instance: With sickle attachment to belt-driven sprayer, driving in and out of jungle-bottom country, day after day, each second of flight is critical. There can be no margin for error. Pilot, airframe and engine must be superb fit.

"We pull our custom-ordered engines every 600 hours, clean spark plugs every 50," David said. "And fortunately for us, we can buy Champion in Guatemala City—well as nearly one place else in the world."

"Passengers, you know, work plus much harder than do other crews, subject them to worse severe operating conditions. When you consider that helicopter engines operate consistently at the high R.P.M. that aircraft use only on takeoff—which causes high electrode erosion and shorter plug life—then

Allied is no slouch... spraying near Mexico City, L.I.



(Advertisement)

"Should floor you at 6,000 feet?"

One of Allied's more spectacular home-front projects involves spraying 1,000,000 acres of marijuana in Texas and demolishing it in Oklahoma. "Removal that would cost rent and you'll have the best well known and famous in the U.S.," conclusion of experts had predicted.

"Caving lava rocks—mined out of lava rock—lava that ranks poor our grandfather's wormholes," David told me. "And already a lot of that 'worthless' is now heavily dug in ground."

On an "industry" methods and maintenance sprayer job, I watched Allied technicians clamping along the ground and shadowed. I watched them sample movements of fields—right up to border vegetation and obstructions—then pivot sharply "at the lava rim," spraying again, without drift, a return south to three to five seconds. They'd land anywhere, anytime—bring no fuel and thermal is their resource. Then off again.

"They test for 'engine death,'" David and I noted. "There were three others, like the old crowshoat and his house, the helicopter pilot and his mechanics—none in our set. The mean out there, Hell, is a pair of his 'copter—and their engine is his heart. He search strong—driven to life by dependable spark plugs."

Allied has sprayed several thousand

acres since April with the

U.S. Army Map Service.

In Government uranium exploration in Alaska, Allied had to haul motor oil before it could be used. "I swear, when it's 40° below up there, I think we must have sometimes drunk the oil and poured hot coffee in the 'cups,' so someone was that day," David said.

With the U.S. Geological Survey and Atomic Energy Commission, Allied "topped" needed 17,000 square miles of some of the most inaccessible wilderness on earth—the Four-Corner country of Utah, Arizona, Colorado and New Mexico. Here, Allied helicopters hauled wild carrots from gorge bottoms to heights where few, if any, made housing analytically possible. They shuttled surveys to hundreds of these populations—averaging 8 to 10 miles apart—so they'd have abundant triangulation points for mapping 20 to 40-foot contour intervals. They logged up innumerable exposures and timber, and between sets—10 to 15 test thermometers! All! They'd haul around average uranium feed off from the ocean floors.

In Alaskan Geologic Survey operations, "toppers" poised during 100 minutes to cut fuel costs for mile-a-mile mapping from \$15 a square mile to less than \$5.

### ON EXPLORATION

Allied has operated under contract to Map of the Americas from South American governments through Latinamerica to the Canadian Rockies and Alaska.

Before Eric will enter on more prosaic southern United States test sites, Allied whirlybirds were setting the loadlines for Gulf Oil. Explosives and refractor shooting were started quickly "from 'shot station' to 'blast station'" in this almost impossible country. Sets had previously took 100 man days, each packing one set of dynamite, three days.

In Alaska and the Canadian Northwest, Allied's "groundhogs" exposed previously unlocated areas for British Petroleum, Alaska, operating well as far as geological survey missions.

In South America, Allied packed in stratospheric, drifts, explosions and cargo supplies through dense jungles—moving in 45 minutes what had taken natives six

days to traverse. Here, Chitosan presented unique hazardous loadfactor caused by hot, moist, operating conditions.

In our own Gulf States, Allied air-lifted trawl-lifted swamps—everywhere! Dams, drilling apparatus to explosives. Seismograph crews didn't even get wet feet! The towed-down "airboats" dragged interior chains, held the winter and flew sideways, up, down and sideways at the seismograph's angle.

### PATROLLING

"Rugged" characterize Allied's patrol duty, too.

With the Tennessee Valley Authority, for example, Allied "bottoms" straddled about 5,000 miles of high-voltage transmission lines for 25 years for clearance of line-to-line low-stage—impacts able by ground inspection.

From fire control projects in Oklahoma and Kansas, Allied flew low along telephone-wire lines so powerful inter-drawdowns would not accumulate ice off wires shimmering in sun.

"Whatever happens about a packed desert or bombing base out of the jungles, it's our duty that you have to live with every day to really accomplish," David said. "It takes quite a crew, quite a craft, quite an investment, and, with a spark plug. You can't say a very successful degradation spark plug than Champion. We have the operation in power—so I say it's in the countryside—'Beyond my shadow of a doubt.'"

Right panel: (L) D.V. Roy, D. David, Allied President, Dallas; (R) V.P. Muller, Kansas.



### SURVEYING

From Alaska to Africa and Ireland, Allied has done government surveying and transporting of heavy equipment and machinery where it's often impossible by other means.

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Honeywell Three-Axis Turn Rate Transmitter. Dimensions: 3.0" x 4.2" x 5.04". Weight: 5 pounds.

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The Honeywell Three-Axis Turn Rate Transmitter, featuring three Gyratran monolithic gyroscopes, was selected for the new Convair T-106 "Delta Dart" all-weather jet interceptor. Because the stability augmentation subsystem of the jet's flight control system, the Transmitter detects the rate of turn about the yaw, pitch and roll axes and responds with an output signal whose voltage is proportional to these input rates of two.

This system is designed to operate under the most severe environmental conditions to which a combat aircraft might be subjected. The Honeywell Gyratran Gyros are easily capable of withstanding the severe shock, vibration and temperature requirements of this application and as such are mounted directly upon the base casting without shock mounts or apparent dynamic characteristics of the system.

The electronic portion of the Turn Rate Transmitter amplifies and demodulates the Gyro output signals to provide polarity sequencing of outputs proportional to the corresponding input rate in each Gyro.

Investigate Honeywell's ability to develop, engineer and produce flight control systems for today's most advanced aircraft and missiles. Write for brochure GN-1 to Minneapolis-Honeywell, Boston Division, Dept. H, 40 Lake Street, Boston 25, Mass.



## Honeywell

**H** Military Products Group

short. The payload should weigh between 2,000 and 3,000 lbs.

Spartan III's radio frequency is approximately 31.035 mc. A second frequency, which could be a second transmitter or receiver of the first, is at 49.81 mc. The Bantam may make its trial flights and an addition should be included in the cone to protect the capsule. Lockheed Missile Systems Division has noted that the cone is tumbling at about 4 gpm.

### REFERENCES

- (1) All figures below are Lockheed Missiles Systems Division captions.
- (2) "Bantam and Spartan: Another AFSC Test Vehicle," AFSC News, Vol. 1, No. 2, 1965, and R. D. Schaefer, "A brief review of recent developments of the Bantam," AFSC Technical Memorandum AFSC-TM-65-100, presented Oct. 23, 1965, to the AFSC Test Vehicle Panel, AFSC, Wright-Patterson Air Force Base, Ohio.
- (3) "Bantam: Interim Test Summary," AFSC Report AFSC-TR-65-100, AFSC, Wright-Patterson Air Force Base, Ohio.

## Star Tracking Unit Operates in Daylight

Heretofore, Cislunar long period light detection was based on calibration of successive scans of the star field to track and within developed by Northrop Division of North American Rockwell, Inc., can, during the night as well as night hours.

Now comes a new part of the art that high ambient light of annual diurnal does not affect its ability to locate, lock on, and track a star over sunburst close to the sun according to North American. Small amount of light deflected produced by the star being tracked, in comparison to normal light at the part of the star being sensed, is applied to the sensor to quickly enable fire lock on and tracking.

Starlock and tracking units will be used for space navigation as well as for stellar guidance systems for guided missiles such as the AGM-28 Hound Dog, Northrop says. It can also be used in a check or inertial navigation system to clean a hot air vented part of an automotive stellar navigation device.

## Kodak Studies Problems Of Missile Photography

In conjunction with problems involved in photographing atomic or flight tests that the effectiveness resulting from and sharpness are required at 500 cm of the objectives. Therefore, the "Show-Off" film that can be exposed in the atmosphere to withstand these effects.

Research is progress at Eastman Kodak, Rochester, N.Y., who bring out the importance of correct exposure in photographing missiles. Kodak reports that with correct exposure smaller warheads can be completely hit.

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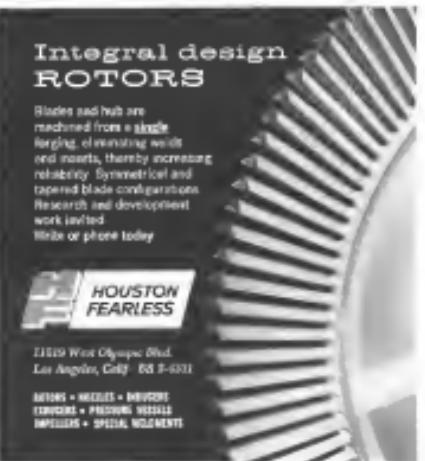
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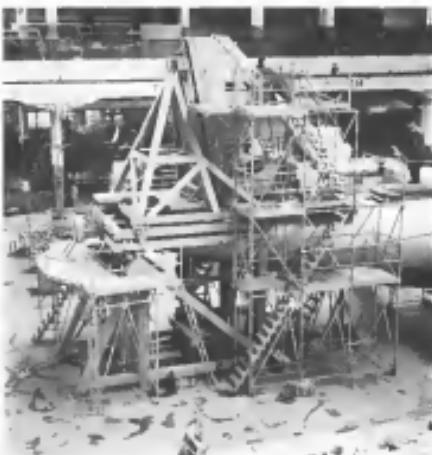




CARAVELLE No. 1 prototype during Sud-Aviation's Vertical System markings, touches down after another series of flight tests.

## How Sud Builds Caravelle Jet Transport

By David A. Anderson



VERTICAL tail fin is made in triangular structure fitted to second Air France Caravelle.

Toulouse, France—Sud Aviation's first production Caravelle were to be delivered to Air France but have rolled out of the final assembly area here.

Behind it on the line are about one dozen more, destined for both the French national carrier and Sud-Aviation Aviatis. SAA gets six of these first 12 production planes. Both nations expect to introduce the new jet aircraft into European service next year.

Total firm orders for the Caravelle so far are reported as 140. Air France (12), Air Inter (10), Air Afrique (12), and Air Algiers (12) total. SAA bought six, and Air Afrique 19. Ying has ordered two. Tunisair C/TY bought three and Air Algiers four. Others scheduled and for all firm orders to be filled by April 1960 at the latest. Thus Sud Aviation is committed to deliver with 26 Caravilles during the next two years. It is this low average delivery rate that has caused so much misunderstanding about the capacity and the ability of the French firm to turn out airplanes.

After visiting any of the production factories operated by Sud, a technical observer is impressed by Caravelle tooling which reflects latest techniques in quality and quantity production. Such tooling, quality control, visual aids for trouble shooting, surface fixtures,



WING STRUCTURE and vertical stabilizer attached, Air France's second production Caravelle nears final completion.



WING-FUSELAGE turntable (right center) is used to guarantee interchangeability of the radial connections.

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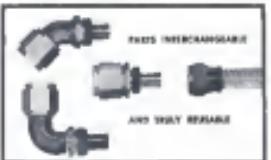
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only all use a gas with the heat in the United States. Millions of kilos per pound of surface weight also requires delivery to the figures reached in the United States.

In spite of that, the fueling possibility—preferably owing American and British engineers—that Centauri gasoline gas is too slow. It permits the reuse of components, was without too much attention to the circumstances that has governed its low speed.

Manufacturers both Boeing Airplane Co. and Douglas Aircraft Co. will complete delivery of four refueling tank designs to the Airports in the summer of 1968, according to their present schedule. Each tank will have turned out about 150 foot per transports during the same time interval that Centauri will be delivering 35 twin jet transports of much smaller size.

But the number of explorers who are impulsive to hamper production the Douglas Santa Monica division probably is about the same as Seal-Off's. All major contractors, including the 250-ton and larger, the Centauri Seal-Off building parts for other French firms under subcontract, plus its own. Various other foreign borders, the Alasota helicopter and a limited number of experimental and development planes like the Trident and Broadwind, plus some effort on missiles.

Total number of planes including the subcontractors working on Centauri production is about 3,000.

From that does not make the Centauri production company difficult with that of the famous 707 units of the Douglas DC-8. Since the two contractors cover the Centauri situation, some of them may be understood before any cold comparison can be made between both production rate and that of one other company.

#### Production Problems

As far as American production experts would like to have the job of producing implants in France. His first reaction is almost certain to be strongly negative, not because he is from the United States that knows practice, but because he is from the low cost labor edge of the continent.

American production experts, including Europe for the field have no way to easily compare with us all knowledge of production problems and the application of new techniques. What they don't generally see are the difficulties that breed a response at once, that a

- Foreign governmental instability has a devastating effect on administrative levels in private interests. They may not place a long-range program, and a French engineer when he won't even know if we will have a budget tomorrow."
- Sudden devaluation of the franc,



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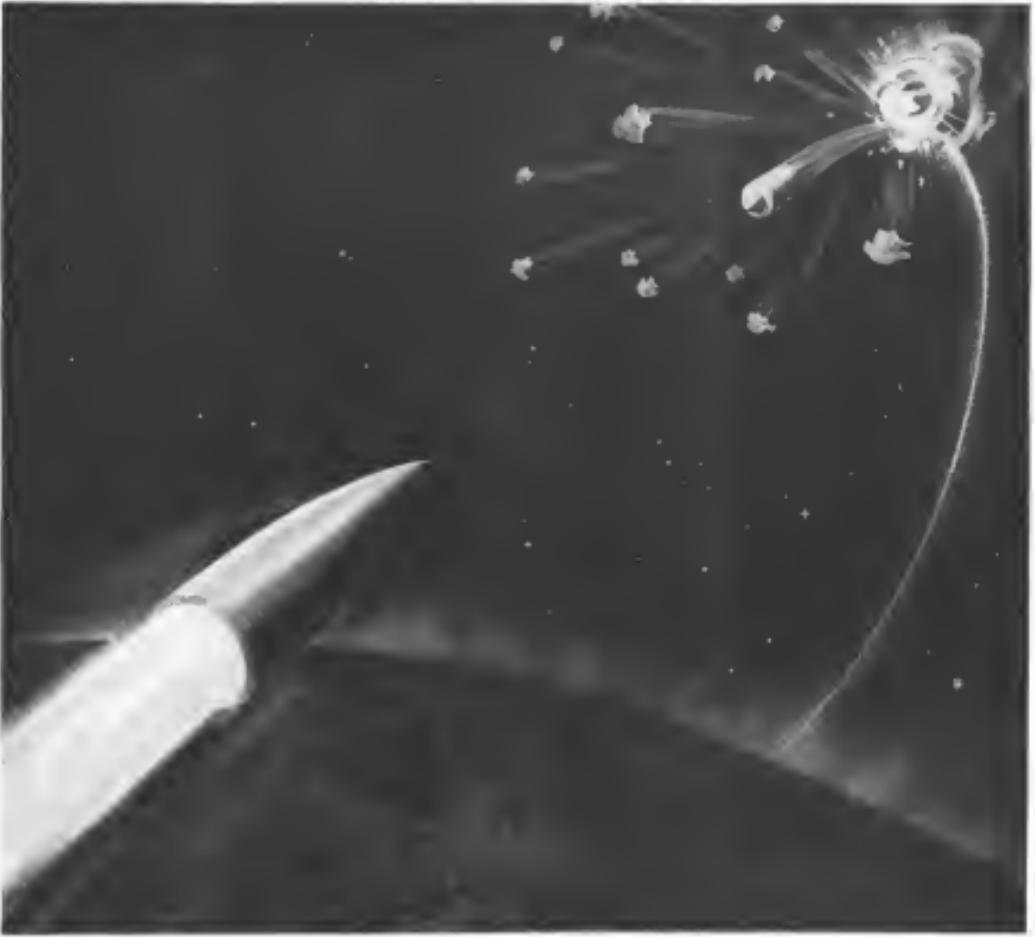
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## HOW CAN AN ANTI-MISSILE MISSILE TELL A DECOY FROM THE REAL MCCOY?

To CONFUSE anti-missile missiles, an incoming missile may explode on final stage rocket casting its approach stage. The resulting fragments would random and travel with the missile, acting as decoys.

That is only one of the AMM guidance and tracking-fusing problems.

There is also the frantic closing period of the two missiles which allows only seconds to resolve and relay course correction data to the launched AMM. And there are environmental problems of extreme acceleration, vibration, velocity and heat that exceed even those found with ICBMs.

At Honeywell, however, solutions are in sight.

The decoy problem may be solved by detecting a peer of the enemy missile near the center of the fragment cloud and ignoring individual pieces. Or, if the fragment cloud does not exceed the effective explosive radius of the AMM warhead, the AMM fuse can simply act on the entire cloud.

For further information, contact Minneapolis-Honeywell, Military Products Group, 2155 Fourth Avenue, South, Minneapolis 6, Minnesota.



The fusing systems for *Sabrestrike* is now being manufactured by Honeywell in quantity. And Honeywell is also producing systems, sub-systems and components for ASROC, Wargat, Thor, Tint, and many classified missiles. The broad spectrum experience makes Honeywell the largest company for anti-missile missile development work.

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Military Products Group

## What's new in TITANIUM welding:

Resistance and fusion welding as fabrication procedures have become increasingly important with the advent of missiles and aircraft designed for sustained operation at Mach 3 and beyond.

Titanium alloys are available which provide fusion-weld efficiencies of 100 percent, and spot-welded joints with excellent load carrying capacities.

Through its own Toscano, Ohio, rolling mills—designed specifically for titanium operations—Titanium Metals Corporation of America can provide light-gage far-cold weldable products of consistently highest quality, on the fastest delivery schedules, at the lowest possible price in the industry today.

### **Q. What are the leading welding grades?**

A. Ti-25A, a single-phase annealed grade which readily welds; Ti-5Al-2Sn, a single-phase alloy grade which provides excellent resistance to oxidation up to 1350°F.; and Ti-6Al-4V, a duplex-phase alloy grade with guaranteed maximum tensile strength is 135,000 psi. Guaranteed titanium mechanical properties of these grades are:

GRADE	DENSITY lb/in. <sup>3</sup>	Guaranteed Room Temperature Properties		
		0.5% H.S.	1% H.S.	Strength in. x 16 ft <sup>2</sup>
Ti-25A	0.261	30,000	60,000	30
Ti-5Al-2Sn	0.261	100,000	117,000	30
Ti-6Al-4V	0.261	120,000	130,000	30

### **Q. Are special precautions required for welding these grades?**

A. Titanium is spot-welded more readily than aluminum and many of the caution and low alloy steels, and requires no special precautions. Spot-weld machine settings used for titanium and stainless steel are very similar.

Titanium is fusion-welded with inter-pass shielded arc welding techniques and joint designs which are also similar to those used for other metals. Two fundamental principles must be considered:

1. Control electrode and after fusion compound cannot be used.

2. Titanium weld joints must be shielded from the external atmosphere with an inert blanket of argon or helium during welding.

### **Q. Does that mean chemicals are unnecessary for fusion welding?**

A. No. Open air welding is adaptable to pro-

duction operations when both cost and fate of the weld are protected from the air. Small parts and complex shaped weldments which are difficult to shield adequately may still be welded more easily and economically inside a chamber. This is described in detail in TMCA's publication, *Titanium Welding Techniques*, Engineering Bulletin #6.



Superalloy vacuum welding techniques have enabled fabricators to produce missile competition through turbines which have attained pressures of 8,000 psi at 320°F. This all-titanium burner, produced by Khammash Industries, Inc., Toledo, Ohio, is 11 inches long, 4½ inches diameter, and has 1,000 psi of thrust at the nozzle of an MIRA.

### **Q. Are titanium welds more susceptible to corrosion attack than the base metal?**

A. Titanium welds offer the same excellent corrosion resistance as the base metal. Satisfactory heat treatments, combined with many other materials, are not required.

Screwless welding is a key factor in today's designs. It enables designers to draw upon titanium's unique combination of properties: light weight, corrosion resistance, and ability to withstand operating temperatures from -300°F to 1000°F — for the added performance vital to these uniquely critical items.

Titanium Metals Corporation of America has just completed the first comprehensive study of welding techniques you published by the industry. The 32-page publication draws upon metallurgical considerations to recommend and explain techniques required for quality titanium welding.

*Titanium Welding Techniques*, as well as other publications, in the most extensive data library in the industry, is available from Titanium Metals Corporation of America, 233 Broadway, New York 7, New York. The important literature is yours for the asking.

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**HUMMER** front predatory jet's front leg has been extended forward on landing leg for maintenance.

misunderstood or misinterpreted, have unshielded layers in most cases.

• French law specifies three-week vacation for jobs above the sea-level. Most companies comply with this by shutting down for the period. Said close during August, so that the holiday break's full three weeks out of the production year.

• "Add to that the strikes," said another engineer, "which never take less than seven days out of an 80-day year, and you find that you are scheduling for 11 months a year."

• France recognizes 11 legal holidays compared to eight in the U.S.

### **Other Factors**

The strikes, even though they last for about a week, are not of direct production for longer periods. The average 24-hr transportation delay to France stopped the motion of all goods by road and rail, sea, rail and air. Railroads stand and tank terminals and docks faced with undelivered waste.

Sud Aviation at Tolouse, which receives Caravelle components from all over France, was hit like every other plant. Delivery of assemblies stopped

in the early stages of production build-up, then it took little time to stockpile parts, and such a shutdown was felt costly. Furthermore, an effect is not directly proportional to the number of days off, but something like a hyperbole function where the production does drops off out of all proportion to the actual time lost.

On top of all this is the French labor pool's problem for all the country's industry. "The only way we could build our Caravelles is to get some people down here," said a Sud executive. "We would have to build housing, schools, doctors, cafes and sport grounds and even then they would not want to move down there." We are told.

They should be moved down there?" We asked. "And that would start right along the coast road." That's where the workers are, in the seaport that's why the Caravelle is built in 11 off-shore locations.

Caravelle components and major assemblies are manufactured in six Sud plants and by five major subcontractors. Production difficulties is like this:

• Wing box structure is built at Sud's Beauvais factory, near Paris, on the Seine River. The factory has

**new  
and full of  
advantages**



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The first aircraft built at the St. Martin plant is about 70 ft long and 100 ft wide and can be thought of as building three large fuselage center sections, building engine bays and the nose and rear fairings.

Two fuselage bays are conventional with smaller wings and front bays are horizontal in the rear side of the aircraft.

RH5 station (left inset) is first stage of Darnell No. 10 production. Ring with doors on both port and starboard sides is forward section of fuselage between cockpit and cabin.

one of the largest collections of aircraft tools in Europe located in almost 1,000,000 sq ft.

\* Wing rear section and leading edge are produced in the Saint Nazaire plant, rear empennage of first step in Vautour production, and the fuselage are set up for both component production and final assembly of complete aircraft. Total floor area is about 175,000 sq ft.

\* Plans are made at Baccarat between Vautour and Concorde. New aircraft have the tail section for the Vautour and Dornier bombers. Floor area is about 700,000 sq ft.

\* Forward wing section is built at Mureaux, near Paris. This operating complex of buildings has a covered area of about 500,000 sq ft.

\* Rear fuselage is subcontracted to the Société Latécoère in Toulouse.

\* Engine assemblies, horizontal and vertical stabilizers are subcontracted to Elettra in Torino Italy.

\* All control surfaces are produced by another subcontractor, Fugere de la Bourgogne in France.

\* Landing gear design and production is the responsibility of Société Dassault which formerly a major engine producer but now making important contributions to landing gear design.

\* Powerplants are Rolls-Royce Avon 512 turbines supplied by the British company.

\* Fuselage cylindrical sections, fusel assembly and flight test are handled by Sod's complex of plants near Toulouse. Canadair prototype shop and design offices are in Blagnac. General production engineering, machine shops, tooling and gearmaking is done at St. Etienne. Final assembly last and the flight test

area is at St. Martin de Traché. Total area of the three Toulouse plants is almost 1,500,000 sq ft.

At the beginning of April, major components for the first 10 Concorde were either in assembly stages or completed and waiting, reassembly. Two prototypes were flying, the first production plane for Air France, was being rolled out, the trial-test fueling was being installed in the static-test facility and the first test flight was about ready to start.

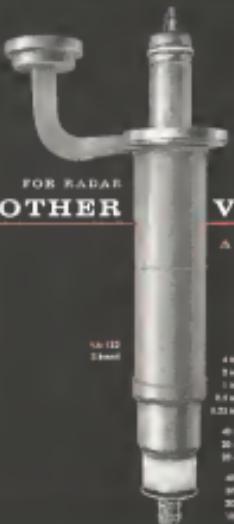
Almost all of the land assemblies area had been cleared for spotting of the air planes being readied for flight. A few small rigs and fixtures remained from earlier production programs but these were fast disappearing.

The first aircraft built at the St. Martin plant is about 70 ft long and 100 ft wide and can be thought of as building three large fuselage center sections, building engine bays and the nose and rear fairings.

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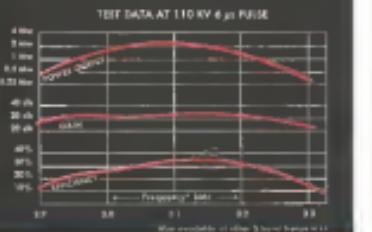
Three panels of these are set up at the rear of the hull and closed, to form a complete fuselage structure including the fairing door. The rest of the fuselage is built up in four lengths of panels on separate frames. One of these are single upper and lower panels consisting of part ring former, dragon and skin. The other two are a wider panel. All four are assembled in pairs at the west base station after the ring buildup.

At the station, fabrication work of the fuselage plant ends and the components made in other locations begin to find their way into the fuselage 10 and



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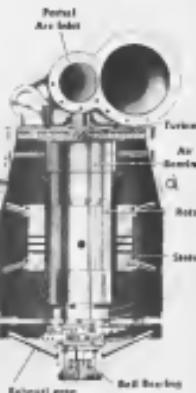


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blades, nest down the line, are held by lockwashers for the complete fastening. Panelled fasteners attach these legs to four stations on the line. 32, 40, 41 and 42.

These four stations start the outrigger installation and base fixture that goes with the fuselage. Measurements at the next station, a set of wings is being rotated for the fast fuselage out of the installation fixture.

Fuselage and wing are joined and moved down the line to station 30, where a large triangular leg is used to mount the ventral tail onto the body fairing. This is followed by a series of legs, rotated and lowered to the spotting arms, where it will receive the horizontal tail, engine nacelles and pylon supports, all be completed and cleaned for pre-flight checks.

### Crossville Walk-Around

The importance of the complete Crossville is that it is a little engine, low-slung and lively. You can walk up and touch the engine; you have to squat to get under the fuselage. A few steps up a ladder, and you can look into the engine inlet in fuselage.

Dimensionally it is within a few feet in each direction of a Douglas DC-9B, smaller in the Crossville body cross section.

Since the prototype was designed and built there have been only a few changes in appearance. The leading edge flap used on the prototype has been eliminated on production airplanes and fixed in the prototypes. The Rolls-Royce Avon engines have been moved forward to improve center of gravity position and stability is longer as a result. Engines now have fairings and these are angled inward to reduce cross flow the struts and dimensions of single engine operation. Dorsal fin has been extended forward along the top of the fuselage for a conventional vertical stabilizer.

Inside the aircraft, two seat sets with seat belt harnesses and the corresponding fuselage length, have been added. Additional aircraft derived equipment will go into the production aircraft for pilot equipment. The de Havilland Comet nose, which was originally bought rather from de Havilland, has been completely redesigned to match Air France, SAS and other airline requirements and to meet many of the international standards specified by pilot and engineering groups.

One noticeable external feature of the Crossville is the dog parallel, which had been an "integral" component for the operator. Some testing of the fuselage for the first time, indicated the need of a 3,000 ft. run for the takeoff of CAR 546. But if the looks feel, the operator will appreciate the insurance of the dog brace. So!

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beginners believe that flight recorders are mere duration oil can.

A little detail is the rectangular hole in the big wing fuel tank which has been designed to be extruded from a still casting molders to a thick walled tube. It has few few wires strung across the opening. Actually it is a fuel system now located in an area of moderate negative pressure. The wires are to keep the leads which needed to be cut when the prototypes were at the stage.

Sad's Jimbo engine, engineer, and design team, headed by Pierre Sarteau chief engineer, and Lucien Faure chief designer have produced an out-

standing good aircraft and already issue flight test engineering checks in progress. Based on the overall concept, which set the new popular fuel system for jet engines, to the detail design the Cassiole shows the result of careful and contemporary design engineering.

One example is the use of extruded stamping instead of engine bars, sections as stock shapes, or in half-tube structure. These stampings have been tested exhaustively. English Electric Royal Aircraft Establishment (AW Mar 10 1957) and in the United States the National Advisory Committee for Aeronautics.

One other example is that the air

conditioning system, which provides hot panel of heat air per minute per passenger is completely sealed. "It wouldn't have been necessary if we had propellers to mask the noise," said an engineer, but the interior is so quiet otherwise that the air-conditioning sounded like Niagara.

A third example is a special device used for major structural frames in the fuselage. This is a elongated section of extrimentum iron, but about half was down the side of the sheeted fuselage. Engineers specified a slot to see in a cable-stay at certain points in the entire skin.

#### Fatigue Life

Stratospheric engineer under Paul Vallet had two basic goals long before life of the structure and a fail-safe design. To achieve these they decided to eliminate even possible structural damage through. This has been carried down to the finest detail, adjustable fastened parts in flying over have been carefully separated so that there is no chance for them to rub together in flight.

The wing box is a continuous and integral housing with no cutouts are required. Landing gear, drag and antenna loads are taken by the heavy-duty integral beam, the landing gear is fitted onto the fuselage so that there is no violent increase in the wing. Box has three survival wells. If a crash should occur suddenly across a section of skin between two of these wells these would still be a closed box to take tension loads and the other skin and wells to take bending and drag loads.

Wing box is made in halves joined on the engine centerline. In part parts between both upper and both lower skins. Each joint is further bonded by a vertical thin metal strip and local joints play the role of ordinary rivet washers but it is the ponds themselves, to the base of the internal frame m.

The original aircraft fuselage starts being an optimum shape, for pressurization. Its construction is quite conventional with thin skin and stringers plus the usual structural bracing. Four beams fit across a chord of the center section and the chain skin and bias stringers are fit into the cone-beam.

Just forward of the engine section and from them off the single wings of the fuselage, as required by leading struts, the fuselage with transverse air tanks to take the loads from the cockpit.

Winglets and empennage carry less. True enough, but the winglet shape is unusual and not selected highly by consideration of avoiding stress concentrations in the design. Winglets contribute an, located on the fuselage leaves the fuselage down itself creates the fuselage fairing load through the downstream. In addition struts connect the main



Simmonds now offers the newest addition to its famous PACITRON Fuel Gauge family—a small liquid crystal digital fuel gauge for military and transport aircraft. It is highly dependable and accurate. The replacement of vacuum tubes by transistors permits Simmonds to incorporate amplifier/bridge and indicator into a single smaller unit, saving space and weight.

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Output voltage	12.5 VDC	12.5 VDC
Current rating	12.5 amperes	12.5 amperes
Regulation	±0.05% (at 25°C)	±0.05% (at 25°C)
Efficiency	75% or better, electrical	75% or better, electrical
Temperature compensation	Up to 100%	Up to 100%
Dimensions	1.50" x 1.50" x 0.50"	1.50" x 1.50" x 0.50"
Mounting	Mounting bracket	Mounting bracket
Temperature operating range	-40°C to +60°C	-40°C to +60°C
Storage temperature range	-40°C to +100°C	-40°C to +100°C
Strength requirements	1.5 g's	1.5 g's
Weight	1.25 lb. (0.567 kg)	0.50 lb. (0.227 kg)
Size	4.5" x 2.5" x 2.0" (estimated)	2" x 2" x 2" (estimated)

West Coast Office: 107 E. Pershing, Berkeley, Calif.  
Eastern Office and Service: 1000 Broad Street, Newark 8, Essex, N.J.  
New York Office: 1000 Broadway, New York 10036, New York.

Canadian Affiliate: Aviation Products, Inc., P.O. Box 4750, Mississauga, Ontario.

Red Bank Division



THE  
DOUGLAS  
**DC 8**  
GOT  
ITS  
START  
FROM  
AIR TORQ



*airtorg*

*gives sure, quiet jet engine starts*

- When the first Douglas DC-8 rolled out of the Kaiser Pier 19th Air-Torq starters rolled with it.
- After rigorous testing and careful accounting of manpower, facilities and experience, Douglas selected air-torq starters with delivery of formal tests turned to support the first DC-8 flights.
- In operation with Douglas, the Air-Torq jet engine starter became the first safe, sure-start and elimination of depreciable noise levels.



The Pro-Jet Air-Torq motor is recommended by Continental as the preferred support for the Pratt & Whitney

**preflite**  
CONTINENTAL AIRCRAFT

100% RELIABLE AVIATION POWER SOURCE CONTROLS

Pro-Jet is in such as: Lockheed Constellation, Pan American, Boeing 707, Douglas DC-8, McDonnell F-101, Convair F-102, Douglas A3D, Douglas D-558, Lockheed F-104 and North American F-100.

The Air-Torq starter is manufactured using the Pro-Jet.

beamwidth portion of the window frame to each adjacent fuselage frame to cover skin with lightning rods is mounted to the rear of the landing struts around the window panels for added strength of the rear. Double plates are provided in the ends of the fuselage skin at the window frames in a similar preparation.

Supplementing the design efforts now is an extensive test program beginning with structural material coupon and going on through vibration and components to the complete airplane. Working with Sud engine on the main program is the staff of the nearby French government test center, D'Establishement Aeronomique de Toulouse (EAT). Wind-tunnel tests of the Canard wing will be done by EAT and much of the speed testing on fuselage, landing gear and fatigue life has been done there also.

#### Flight Test

Carefully, I BHEB, the second prototype, made its 149th test flight on April 1 to check the installation of a new Rolls-Royce Avon engine, due the previous night. Program called for a dash to 75,000 ft as both engines then shutdowns of the port engine, its lighting, and single-engine operation on the port engine to run it through the conceivable light range.

Total gross weight was 77,300 lb, well below normal gross. Ground checks and engine start completed, we stood by to take away power at Sud's St. Martin flight test center.

There was another problem other than engine trouble due to the sponson on the Douglas front landing gear. Landing was bumpy with the usual rough spots and waves, yet there was none of the pitching or bumping usually felt during the ground run of road aircraft.

There was a brief moment of high noise level at Sud and pilot there. No one opened the throttles to full thrust and then released the brakes in like of Wright in, around the nose level while the valve engaged approach and continued to accelerate.

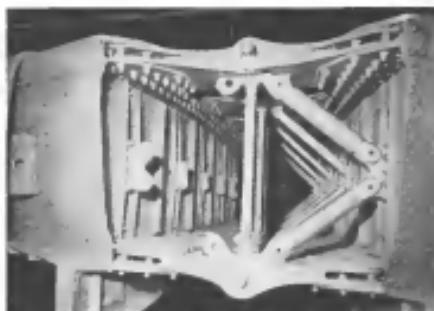
Takeoff acceleration is rapid and unusual, almost like a fighter. Sud tested the Canard for a steady rate of climb through thick sun clouds and moderate turbulence, and we heard a lengthy sputter in the gear atmosphere.

We looked out at about 75,000 ft and continued to dash. Due to the flight test engineers of the top, no order going, placing isolated pauses now, the noise completely masked all the engine noise.

With the noise off, we explored the airplane to get some qualitative impressions of the noise level. In the cockpit, the noise is almost entirely sensory noise, masking behind the pilot and about us



LANDING gear will detail is shown above. Detail of the wing root joint is in photo below.



FUSELAGE cross section below is made in Toulouse. Panels are made in these columns after mass production line. Half fuselage (right) is part of structure over wing center section.



AVRO

# ARROW



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## CANADA'S SWIFT, FAR-RANGING ANSWER TO ANY SECURITY THREAT

Every advance in aircraft engineering is exemplified in the Avro Arrow, capable of traveling at well over twice the speed of sound to intercept and destroy enemy aircraft at extremely high altitudes. RCA has been assigned full responsibility for the development of a complete electronic system for fire control, navigation and communication, and an integrated automatic flight

control system. While an enemy plane is still beyond the range of human eye, this radar system will detect it, and provide the intercepting pilot with a continuous flow of information, electronically computed in terms of position, range and rate of closing. Associated with RCA in the project are the Minneapolis-Honeywell Regulator Company and several Canadian firms.

feet away, I could hear his normal conversation with the copilot, although both men were flying inverted.

Inside the cabin, the observer's permission is that here is the world's first quiet airplane. There is a noise level but it is low and in an inaudible frequency range. Furthermore, it is unaccompanied by vibration except for a small portion of the cabin right over the wing box, where high frequency aerodynamic noise from the air is transmitted into the cabin through structural members.

Noise comes from the rear of the fuselage, but it is not too far into the usual conversational levels and is undisturbed by normal conversation and probably overlooked by the passengers around the aisle.

Noise level is highest in the tailfin at the aft end of the fuselage and in the compartment behind them but not noticeable by passengers.

### Single-Engine Check

We reached 35,000 ft and Nader turned the Canadair straight and level at 235 kt TAS. With the outside air temperature at -54°C., the time-spending flight Mach number was 0.71.

Nader and the port engine in the cockpit were the only ones who made the change in engine rpm on one engine motor. In the cabin there was no noticeable reduction in the low noise level. With the port engine shutdown at 1,300 rpm, the indicated airspeed was 212 kt, and the Mach number was about 0.6.

Radiotele and wing-engine operations were normal but Nader wasn't satisfied with the engine controls. Then he had me walk outside somewhere along the line, with the result that easy possible throttle positions produced a wide variation in gear and thrust. This is not unusual but it definitely is an item requiring a fix.

We landed back in St. Martin and started a several-pilot preflight. Nader opened the av locket; the decompression was indeed obvious, but not insurmountable. That was rumbling noise from the turbines below the forward bulkhead. The fuselage angle was less than during the normal final approach of a Convair 440 Metropolitan.

We taxied down and settled for about 4,500 ft on the wet runway with normal use of the brakes and no brake checks. Turning back to the open road and engine shutdown completed the flight.

First four Canadairs built were prototypes for flight or ground tests. • Convair F-106B, the first prototype, made its first flight Mar. 25, 1955, had completed its official test program for the company and the French government by April 30, 1956. During these tests, it flew 41 hr. In June of 1956, it was turned over to Air France



General Electric's Jet Engine Dept., Cincinnati, Ohio, is now interviewing Engineers with 3 or more years experience in the following fields:

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Be sure to Check Your Field of Interest Above. AW-512



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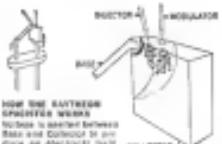
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GENERAL  ELECTRIC  
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# RAYTHEON SPACISTOR



## NEW METHOD OF AMPLIFYING ELECTRONIC SIGNALS



**HOW THE RAYTHEON SPACISTOR WORKS**  
Working is inserted between Basis and Inductor to produce basis voltage. Modulator is connected to the Basis. Voltage on Inductor causes electrons to move in opposite direction to the supply to Inductor. A very small signal current is introduced into the Inductor. The larger current between Inductor and Capacitor results.

The Spacistor—announced in 1957 by Raytheon scientists—is a broad new concept in electronics. It combines the amplifying power of the vacuum tube with the small size, ruggedness and low power requirements of the transistor.

Now in the laboratory stage, this remarkable device gives promise of still smaller, lighter, tougher and more powerful commercial and military electronic equipment—from portable radios to missiles.

First vacuum tube, now the transistor, now the Spacistor—Raytheon has pioneered in all three. This new device typifies creative engineering at Raytheon—the constant exploration of the frontiers of electronics.



Engineering Electronics

RAYTHEON MANUFACTURING COMPANY, WILMINGTON, MASS.

with a total of 410 hr. on the plane. The French nation, like the United States, is concerned over world Nuclear safety, so far as cargo runs to North Africa are going. 109 flight hours per month and putting on a total of 521 hr. for an overall airplane time of 1,052 hr. 16 hrs. due during the tests, the plane made sound test flights from Paris to Casablanca and Paris to Algiers plus a local flight around Casablanca, for a total of 12 hr. and 15 min. utilization during the 24-hr. period. It also flew Paris-Casablanca-Paris on a 2,019 route one way, top in 10 hr., seven min. for an average speed of 322 M.  
• **Cassibile F-104BB:** the second prototype made its first flight on May 6, 1958. Since then it has logged more than 130 test flights and more than 600 hr. in total.

• **Cassibile third prototype** will never fly, but will instead be "frozen" in fatigue tests in a water tank, scheduled to begin at the end of this month at the motor tank at EAT. The Cassibile tests will put an equivalent of 50,000 flying hrs. in the plane. Loads will be applied by wing-leading edge jacks for combined tension and bending, while the fuselage is being cycled through 45° pressurization and depressurization pressure. Fatigue loads will also be fed into the tests. Cyclicing will be done during the 30 hr. off-duty periods, and during the eighth working day, twice of operation at static down will check the trailing 25% wing area and the mid-body. Both of these areas will give over 30 lbs. stress, one 17 lb. gust and a drama 30 lb. static.

• **Cassibile fourth prototype** is a static test aircraft, scheduled to start its testing in June.

First production Cassibile for Air France has been added out and will be followed shortly. In the second prototype, scheduled to be the first for 536 assignment of aircraft will follow in the last 12 production Cassables.

### Dassault Mirage IIIA Designed for Mach 1.8

Fuselage-Dassault Mirage IIIA, military version of Mirage III, has been selected as interceptor aircraft in Mach 1.8 range.

Mirage-Mirage IIIA is equipped with SNECMA Atar 9 radial engine, pushing 13,200 lb. thrust, plus a SEPR rocket engine of 1,100 lb. thrust. French air force has ordered 100, probably will order an additional 200.

Sweden also has fitted Atar 9 turbo jet into Dassault Super-Normandie, the flying model prototype, which is currently undergoing Atar 101G engine of 9,000 lb. thrust. First French air force experiments are expected to begin spring time that summer FAF has ordered 250 Mirages.

### proposed new issue

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(per value \$1)

### offering price \$10 per share

On single transactions involving less than \$10,000.

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These shares will be offered to the public commencing on or about June 17, 1958 through a group of underwriters headed by the undersigned.

A registration statement relating to these securities has been filed with the Securities and Exchange Commission but has not yet become effective. These securities may not be sold prior to such date, or until an offer to sell has been accepted in the manner of a registration statement becomes effective. This advertisement shall not constitute an offer to sell or the solicitation of an offer to buy and shall there be any sale of these securities in any State in which such offer, solicitation or sale would be unlawful prior to registration or qualification under the securities laws of any such State.

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A copy of the Preliminary Prospectus may be obtained from your local broker or dealer or by writing the undersigned.

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ARCHBALD, PENNSYLVANIA



CINE-RADIOGRAPHY, uses X-ray movie technique, reveals basic cause of malfunctions in avionic, hydraulic, pneumatic or mechanical devices and equipment. Technique enables engineers to see what is taking place inside when device is subjected to adverse environment.

## X-Ray Movies Record Equipment Failures

By Philip J. Klass

Cineradiography, new technique which employs combination of X-ray and motion picture, makes it possible to probe inner workings of avionic, hydraulic, pneumatic or mechanical devices and equipment while it operates to ferret out latent causes of failure and wearability.

Device or equipment is exposed to X-ray beam and its internal structure is checked if desired, and the X-ray fluoroscopy screen is photographed as various pressure points operating up to several hundred times per second. Re-selated movie can then be projected at normal speeds over and over again while engineers analyze what is taking place inside the device or equipment with no need.

### Detective Work

Here are two examples of extending X-ray detective work in finding latent failures and unpredictable cause of malfunction:

- Encapsulated servo amplifier, employing two silicon diodes, shorted internally when subjected to voltage assistance wave. Individual components, including resistor were tested individually under severe temperature and performed satisfactorily.

• Hydraulic servo valve for nozzle control of compressor which ignored them. Hydraulic servo valve fail because of faulty valve operation when subjected to full pressure. Engineers knew that there was anomalous rise pressure in the hydraulic fluid, but when valve was disassembled following a series of buildups of contaminating material. Cineradiography revealed that a certain pressure buildup normally was taking place which caused change in flow pattern that worked over the buildup. This action repeating at a high cycle rate, proved to be cause of malfunction. With this knowledge, engineers made flow pattern to prevent contamination buildup.

Rotolab Laboratories, Lynbrook, Calif., is pioneering the ever evolving X-ray technique. So far as is known, Rotolab is only company in the country currently equipped for carrying out cine radiography. Joseph Drayton, president, however, would not allow us to consider his institution the only X-ray facility. Drayton's

use of X-rays for static examination of photographs of such devices as vacuum tubes is not new. Having been used by Bell and some vacuum manufacturers for several years.

### How It Operates

Device to be analyzed is encased tightly in a glass bell jar. X-ray machine and fluoroscopy screen so that a sharp focus is obtained. Motion picture camera is set up on opposite side of screen to observe pressure, contamination and other changes in behavior of device.

State of affairs which can be followed depends upon power of X-ray machine, thickness of material which must be penetrated and the desired movie speed.

A 1,000-watt X-ray machine, for example, can accommodate a gun size two square feet in area, with frame speed of 120 per second. Smaller gun points can be photographed at higher frame speeds using lower X-ray voltage, according to Rotolab's Dr. Irving Reitman.

At present Rotolab can work up to frame speeds of 100 per second, but is developing new techniques and hopes to acquire equipment which will enable it to operate up to speeds of 1,000 frames per second, for analysis of ev-



X-RAY of motor operating without removal of insulation (top left) shows normal distance between rotor and stator. When external vibration has been applied (right), X-ray reveals movement of rotor position and stator contact. Below, an hour's worth of wear is evident in second position (left). After vibration (right), outer coating is delaminated (arrow No. 1) and collar holding mounting fixture (No. 2) is shown to have broken free of catch arm.



recently high speed motion (100,000 rpm) and vibration.

Value of microangiograph, pattern book for extrusion wall thickness, and spectra under insulation can be greatly enhanced by use of the X-ray fluoroscopic system and the time it requires according to A. J. Rausen, Research Director of the company. With dual-circuit TV, an portion of the image on the fluorescent screen can be blown up in size, when displayed on TV picture screen.

#### Preliminary Studies

Concentric TV also can be used for performance studies of devices under X-ray analysis, in order to determine which devices should be photographed and under what environmental conditions.

Sizing is work. Film should print out of closed circuit TV equipment in about one hour.

Concentric TV also is important addition when working with high volt-

age machines where radiation presents hazard to human operators working too close to fluorescent screen. Use of a monochrome TV monitor for viewing specific process of adjusting sample position to obtain desired view and sharp focus.

#### Special Techniques

Rausen has devised number of special techniques for further colorizing the usefulness of time-micrographs, when required, including:

- Motor (3-D) microangiograph, where depth perception can aid analysis, is affected by making two micro films. One is made with X-ray machine fluorinating specimen from one position; the other with a modified slighter and reversed film so that it is not a repeat.

■ Stroboscopic cinematography, using electronic strobe-lighting, permits visualization of camera shutter speed and X-ray pulses to produce stopping at high speed motion of elements of device under observation. Technique can be employed, for example, to study

of high-speed rotary components like motors.

In addition to trouble-shooting faults, microangiograph also can pin off in focus for quality control and in quality of manufacturing production, according to the designer.

It also should be a time-saver for engineers during initial design phases, particularly for mechanical, hydrostatic and pneumatic devices where pressure or gases could easily speculate on internal operation based on external device geometry.

#### Financial Support

Rockwell Laboratories hopes to obtain financial support from one or more military services to expand its present microangiograph techniques for industry.

This will include developing techniques for handling larger, more difficult components and devices, as well as exploring new applications for the technique. Company's address is 2815 Las Flores Blvd., El Cajon, Calif.



## T/I transistorized 'peeping drones'

*see better...fly farther*

**Transistorized radar...** and other Texas Instruments "electronic eyes" can peg the shape, location, motion, heat, and magnetic character of "targets of opportunity" ... relaying this vital data for action in those brief moments that the opportunity exists! In manned or unmanned reconnaissance aircraft, T/I's light, tough and compact electronics save fuel, space and weight while trimming maintenance and logistic problems.

Discussion of this advanced reconnaissance capability can be arranged on short notice. Authorized industrial or military personnel write or wire: Service Engineering Department...

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Some weldments are heavy pieces of beefed-up hardware to help put an ordinance-type missile into the air and on target ...

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The Jet Division produces both types . . . the shapes rolled from plate and the shapes stamped out of sheet. They can be made from either alloy or stainless steel, as well as titanium, monel, and other missile-age metals.

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WRITE FOR BOOKLET AN-154 which describes  
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**JET DIVISION**  
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## NEST

The higher you are, the farther you can see. The same applies to radar. The smaller crow's nest for radar is the Grumman NF-5 Tracer. With electronic eyes set at an aerodynamic slant, the Tracer can track distant aircraft and high speed weapons and give early warning to its task force.

The NF-5 Tracer is another example of Grumman helping to make the United States Navy the most effective police force in cases of international delinquency, plus a deterrent to all out aggressions.



GRUMMAN AIRCRAFT ENGINEERING CORPORATION  
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## High-Level Radiation Probed by Scientists

Washington—U.S. scientists are racing rapidly to learn more about the nature and source of high intensity radiation discovered at altitudes above 60,000 feet over the continental U.S. by Explorer I and III satellites (AW May 4 p 18).

\* \* \* \* \*  
Scientists capable of determining whether radiation comes from particles or from X-ray radiation resulting from electron bombardment of satellite shell have already been contracted and probably will be flown in as early as June.

\* Launching of satellite into high-altitude (near-polar) orbit may be at hospital from USAF Malmstrom Test Center, Cape Canaveral, Fla., before the end of the year to determine whether intense radiation is found at lower altitudes near the poles, as the three new suggest.

Intensity of radiation experienced in the U.S. satellites, which would give a complete passenger measurement, probably change in only two to four years, can be reduced by 90% with appropriate, one millivolt of lead shielding, according to Dr. James Van Allen, International Geophysical Year panel member who reported the area findings in the National Academy of Sciences.

Present theory on the intense radiation is that it comes from a layer of ionized gas, probably hydrogen, which is periodically emitted from the sun during periods of solar flares. Electrons and protons in the gas plasma appear to have extremely high energy levels or intensity of the earth-around 100,000 degrees Kelvin according to Dr. Van Allen.

The earth's magnetic field is believed to act as a shield which prevents most electrons and protons from penetrating lower altitudes. Electrons are believed to spiral back and forth along the earth's lines of magnetic force up to 600 mi. altitude, coming down to lower altitudes only near the poles where magnetic field converges. Radiation is believed responsible for the aurora phenomena observed at high latitudes.

If the high intensity radiation is found at lower altitudes near the poles, it could support this theory. Present U.S. satellite orbits are limited to about 54 deg. or either side of the equator.

Some of the electrons and protons gradually sweep down below the full altitude at lower latitudes, scientists believe, but these greatly disrupt flow energy in the more dense atmosphere; hence, they are not detected at lower altitudes.

## Beattie-Coleman built 100 g's into the MPR-13 Programmer

Resistance to high shock levels is just one of the amazing places of the Beattie-Coleman MPR-13 Pushed Mylar tape Programmer. It is accepted standard for multi-channel programming because of its compatibility with most missile guidance systems... and provides with an accuracy of one part in 50,000 under these harsh "G" loads. Programs can be updated or altered in a few minutes with a resolution precision of either or port cycling or random operations.

The rugged double-diskette MPR-13 Programmer measures less than 6" x 7" x 10". More information is available on request.



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# GIANNINI FREE GYRO

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# TALOS



**GANNINI MODEL SIDE FREE GYRO WITH THE HELM IN THE NAUTI TALOS** Mid-course guidance of the TALOS missile is achieved by riding a radar beam to the vicinity of the target. Immediately after launching, aerodynamic considerations require the missile to fly a straight and narrow path, maintaining constant altitude. Giannini Two-Axis Free Gyros have been piped aboard the TALOS to hold it "steady as she goes!"

Recently Developed Giannini Side Gyro System  
Low Drift Axial High Number  
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G A GIANNINI & CO., INC., P.O. BOX 1000, PHILADELPHIA, CALIF.

## Expansions, Changes In Avionics Industry

Wright-Patterson Electric Corp. has established a microwave research and development center in Utica, N. Y. The outfit, part of company's electronic tube division, will be headed by Ernest C. Glaser.

Other recently announced changes expansion new facilities in the avionics field include:

- **Sylvania Electronic Products, Inc.**, has officially opened \$5.000 sq ft of Advanced Engineering Laboratories, near Buffalo, N. Y., which is engaged in research, de-



velopment and production of counter measure radar, navigation, communications and other avionics systems. New facility occupies about 750 square feet of three separate and insulated

- **Gulfstream Industries, Inc.**, has formed Digital Device Department, which will apply micro-computer techniques to data separation and reduction in analog and digital systems. Department is assigned to CG Electronics Corp., Albuquerque, N. M., which owned Gulfstream subsidiary Harry B. Boring flight department.

- **Rockwell International Co., Palo Alto, Calif.**, has set up four new product divisions in reorganization of its research and development department. The space power division is headed by Alan B. Bunting, Northern California heads overlaid optics division, W. James Wicker heads intermediate and signal processor division, and John M. Gage heads audio and video equipment division. Company also created standards laboratory, technical design and ad general development sections.

- **Amplivac Electronics Corp., Chicago**, has formed new Cable & Wire Division to be headed by James B. Solman. Headquarters are located at Amphenol's Plant No. 4, Elgin and Elkhorn.

- **International Telephone & Telegraph Corp.**, has consolidated all its U. S. research and development activities into a division to be known as ITT-T Laboratories, located in the command center of Federal Telecommunications Lab, Eatontown, N. J., formerly Holmdel. C. C. Smith, formerly development manager, Ft. Wayne, Ind., and manager of Kollgen switchboard & Supply Co., Cloughs, New division is headed by Hiram Baumgard, president of PTL for past two years.

- **Siemens**, West Germany, has established a new plant in Berlin, Germany, to produce electronic components and assemblies for the European market.

## EQUIPMENT



**FIGURE 1** Transporter for USAF's Stock or 10-wheel transporter made by Nuclear Products-Lynn Division of ACF Industries, Inc.

## Missile Handling Becomes Big Business

New York—Ground handling and support equipment for missiles is expanding so rapidly that some ground handling experts have suggested the industry they support in terms of job opportunities and job assignments.

In the past, missile handling vehicles were used as a means of transport. Now industry suggests that the vehicles are a vital part of the entire missile program. Sign of this new respectability is the fact that the American Ordnance Assn. has formed a missile handling group within the past year.

Government officials point **Aerospace Week** statistics for the defense agency's share allocated for ground support equipment and the missile industry's share reported.

First supplemental 1975 appropriation for missile ground support equipment for all the armed services is \$7.4 billion. For missiles, \$10 million.

### \$900 Million for USAF

Of the \$1.4 billion total, Air Force's total is \$900 million. Here is how USAF plans to spend its share:

- \$190,000,000 for Link trainer and conversion of ground support equipment and IRBM/ICBM sites
- \$190,000,000 for application of DCPI ground support programs
- \$170,000,000 for electronic ground support equipment
- \$160,000,000 for research and development programs for ground support equipment
- \$80,000,000 for classified ground



**FIGURE 2** Missile (above) is mounted on Fruehauf trailer Co. mobile launcher. Below, Fruehauf transporter for Titan intercontinental ballistic missile is loaded into C-144



# Electra/Flight



## Performance as promised

All Electra Guarantees met—or exceeded in Flight Tests

### Proved Short Field Capability

Flight Tests show the Electra landing descent and stopping characteristics will more than meet guarantees. In fact, the Electra is consistently making stops using less than 2,500 feet of runway.

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**"Belt-Free" Flights**—On a typical 400-mile trip, Electra spends only about 15 minutes in climb, descent and turn. 35 minutes is level, comfortable flight.

**Open/Closed Weather Flexibility**—Electra assures passenger comfort by being able to take off and fly at any altitude from 5,000 feet to 35,000 feet with less than 1% variation in speed.

### PROVED POWER PACKAGE

Electra's 4 General Motors Allison Prop-Jet Engines will have accumulated a combined total of 350,000 ground and flight test hours before entering airline service this fall... one of the most comprehensive engine-package test programs ever undertaken.

### DESIGNED-IN LOW MAINTENANCE

Electra has major components grouped into "man-height" central service areas. These easy interchangeable areas with quick plug-in connectors—refueling en route delays, down time and costs.

### ASSURED LOW COST OPERATION

**Assured Low Factors**—Enter an "flat traffic matrix," Electra's 85-seat capacity offers an opportunity for profit. Assuming a 50% break-even figure, the Electra will need only 44 passengers, contrasted with the 50 or more needed on the turboprop's 120-seat capacity.

**Low Cost Power**—Electra's efficient prop-jet engines give more horsepower for every fuel dollar.

**Low Fuel Consumption**—On a typical 300-mile flight, Electra can fly at any altitude from 5,000 to 35,000 feet with operating costs varying only 2%.

### Complete After Sale Support

Lockheed's new "Electra/Flight" advertising and promotion theme is now appearing in business magazines, soon begins in the pages of national and international mass media.

Electra purchasers get complete in-service operational support—including continuing spare parts service, world-wide field service, ground and flight training support, special introduction teams and other valuable assistance.

### Purchased by

Aerovias de Mexico • American Airlines  
Ansett/ANZ of Australia • Braniff Airways  
Cathay Pacific Airways • Eastern Air Lines  
Ganda Indonesian Airways  
KLM Royal Dutch Airlines • National Airlines  
PSA • Pacific Southwest Airlines  
Western Airlines



## LOCKHEED ELECTRA

The finest short-to-medium haul turbine-age airliner...designed to assure you maximum return on every operating dollar.

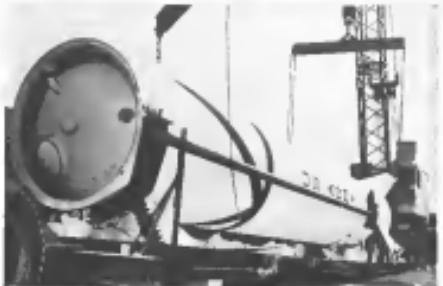
LOCKHEED AIRCRAFT COMPANY, BURBANK, CALIFORNIA



HILL Board is carried on Transporter-ER vehicle made by Lear Mfg/Div., C.



Liquid oxygen tank, loaded onto Douglas C-133, is manufactured by G. Cambridge Corp.



KEITHSTONE missile carts are used. Slave shock absorbers connecting cart to missile supports

#### support equipment projects

- System with which ground support equipment dollar expenditure in growing compared with similar expendables for missiles is understood by these systematic fiscal allocations
- \$123 billion was allocated for the entire missile ground support equipment program in 1957
- \$305.5 million is programmed for the same purpose for 1958, an increase of \$27.7 million over 1957
- \$88.8 million was allocated for reusable items in 1957
- \$88.8 million is programmed for reusable items alone in 1958, an increase of only \$1 million

#### Missile Job Assignments

Job assignments—or personnel—for missile ground support equipment often exceed those for the missile itself, Irving J. Mautz told Aviation Week. Mautz, who has been general manager of Chrysler Corp.'s Defense Operations Division since late 1956, recently appeared at group exercises to choose a chairman for the newly formed Missiles Division. He also will continue to direct the Defense Operations Division.

Ground support equipment requires some job assignments, Mautz said, because missile ground checkout gear incorporates almost as much electrical, pneumatic, and hydraulic equipment as the missile itself. On top of the ground checkout of almost all uniform, communics and munition, there are those exclusive to missile ground support as transporters, fuelers, elevators to place missiles on the launching platform, launching platforms, and a vast array of mobile gear.

New transportation will be responsible for Chrysler's participation in development engineering and production of the Redstone and Jupiter programs under a \$12 million contract awarded last January.

Varied group of companies enter into the business of making ground support equipment as the market begins to expand.

Some are well-established aircraft firms, such as North American Aviation Inc., which is selling transports for the Marine Corps' three intercontinental ballistic missiles.

Others are long-time missile supply contractors to the aircraft industry, such as General Aircraft Corp., which is responsible for about 70% of the major ground handling equipment for the TM-5A. Major ground missile equipment units also being made by Martin.

Still others are relative newcomers to the aviation/missile business such as Bond Machine and Cheever Corp., whose Guidance Division makes the transport-erector for Douglas



# Flight Comfort

FOR MODERN'S

In an age of jets, passengers demand the ultimate in comfort. Interplane seat manufacturers are provided a wide latitude in materials with which to fulfill these requirements of style and comfort.

Aerotherm, the name on the finest aircraft seats in the world, adds another requirement to the list...energy absorption. Studies in this field point the way to the further deindividualization of aircraft seats...the ultimate is a trend toward greater safety and "Flight comfort for moderns".



Designed for Energy Absorption

Project Engineers THE THERMIX CORPORATION Greenwich, Conn.

THERMIX CALIFORNIA, INC. 5225 Balmuda Drive, Culver City, Calif.

Canadian Affiliate T.O. CROWN LTD. Montreal, Quebec

THE AEROTHERM CORPORATION

Manufacturers

**THE THERMIX**

**AEROTHERM**



**HOT, COLD OR BOTH!** At home, temperature extremes can add to your comfort and pleasure. But when you design and produce a sensitive component or complex system associated with today's flight, heat or its relatives absence are fighting you every step of the way.

To meet this challenge, we at CECO support our design and production experience with some of the frost testing facilities available—among them, a new laboratory capable of running extensive fuel systems tests in ambient temperatures as high as 1,000° F.\*

At low extremes of today's thermometer, we are designing, developing and producing equipment for use in the cryogenics field.

## CHANDLER-EVANS • WEST HARTFORD 1, CONNECTICUT

\*On a limited basis, this laboratory is available to others concerned with effects of high temperature on fluids, pumps, controls and systems.



Our intermediate stage ballistic and the Company also makes a tracked mobile trailer for the Black ground track trailer.

### Company Survey

**AVIATION WEEK** made a number of 16 companies engaged in the manufacture of mobile ground handling and support equipment. Here is a summary of those surveyed (companies are listed right to left).

\***America Beach Area Corp.** is building ground electronic test equipment for the missile components of the industrial guidance system it is making for Martin's Titan ICBM. Work is being done at a new plant the company is currently opened in the Chicago area for the design, development and production of ground support and test units.

\***American Car & Foundry Co.** makes the transport/launcher for Bell Aircraft Corp.'s Ramjet air-to-surface missile. Vehicle was designed in Bell's ACF and is under the budget for Boeing's B-52 intercontinental missile.

\***Baker Industrial Tools**, Pasadena, Calif., has been granted a contract for preparing and lifting the C-130 panel surface-to-surface missile made by Fairchild. Tex. & Baker Co. under contract to Jet Propulsion Laboratories, California Institute of Technology, Ladd Manufacturing Co., a producer of Baker, made a mobile vehicle for Bell's Ramjet.

\***Cambridge Corp.** is making king-size thermal tools to strip liquid oxygen used to fuel Thor (IRBM) Air transport tanks (no Douglas C-130). Tools are more than 10 ft long, 5 ft high and have a capacity of 13,000 gal.

\***Cron Systems, Inc.**

under subcontract to the Defense Systems Division, contractor for Project Solenader, has built an underground modular container for fire and way of Concourse's Interceptor surface-to-surface missiles and Helios (air-to-surface penetrable) mobile trailers which the company says are presently being programmed as operational versions for Air Force and Army missiles being fired at Cape Canaveral, Fla.

\***Ford Mackayne and Chemical Corp. Defense Division** is going into production of ground support equipment for Thor IRBM. Equipment includes transportable mobile vehicles which house hook and cable equipment, trailer and power pack trailer containing hydroelectric systems required to activate initial stages of the firing sequence.

Corporation makes a tracked transport and loading vehicle for Raytheon's Hawk nuclear-air missile. Contract is to build launcher-erector and power pack units for Boeing Bomarc intercontinental missile at San Jose, Calif., plant.

\***Frontend Trailer Co.** Mobile Prod.

Division is making a variety of

mobile vehicles at Martin's Titan ICBM, Chase Vought Rega, ICBM II surface-to-surface missile, Convair's Redstone surface-to-surface missile and Douglas Goose air-to-air nuclear warhead mobile.

\***General Electric Co.** Missile and Ordnance Systems Department is building a mobile electronic mobile work station and launching trailer for Radial Tailor surface-to-surface missile. This is the company's first contract for missile handling systems. Department also is equipping large vans with complete electronic checklist equipment to test some 600 systems the company is making for Atlas ICBM and Thor IRBM.

\***General Mills Inc.**, Mechanical Division is at present making mobile ground support equipment under subcontract to AG Spark Plug for Martin's TM-76A Mart missile and for Ed Ted's Jet Propulsion Laboratory an Christie's Jupiter IRBM.

\***Gooddy-Auditor Corp.** is preparing a mobile electronic mobile work station and launching trailer for Radial Tailor surface-to-surface missile. This is the company's first contract for missile handling systems. Department also is equipping large vans with complete electronic checklist equipment to test some 600 systems the company is making for Atlas ICBM and Thor IRBM.



• We've built mobile trailer units for completely mobile test facilities, car trailers and semi-trailers. Each trailer is custom or standard built to meet your needs. Mobile trailer units are built from aluminum in all pressure-tight sections. 200 to 800 cu. ft.



• We've built mobile trailer units for the best low-altitude aircraft for the primary market. Our mobile trailer has a circular rear section. It is built from aluminum for maximum strength. The trailer is only 10 ft. high — it is ideal for road or portability in mountainous areas. These mobile trailer units, 200 to 800 cu. ft.

The Miller  
**GOLD STAR**  
ALL STAR LINE





• Completely self-contained trailer units for up to 100 cu. ft. These mobile trailers feature a self-contained water system. Each trailer unit is supplied with a water pump system which provides water to test areas. Portable trailer units are built in high frequency, low pressure, high pressure, and vacuum systems. All trailer units are built from aluminum. Each trailer unit is built with a central control system to control efficient flow of water.



• An trailer for low-altitude aircraft. Completely self-contained trailer units with Miller's unique control system which provides water to test areas. Portable trailer units are built in high frequency, low pressure, high pressure, and vacuum systems. All trailer units are built from aluminum. Each trailer unit is built with a central control system to control efficient flow of water.

Complete packages on any of the above trailers will be sent promptly.

**miller** ELECTRIC MANUFACTURING COMPANY, INC. Appleton, Wisconsin  
Branches or Agents in Canada by Canadian Metal Co. Ltd. Newark, N.J.



## MODERN JET AGE AIRCRAFT DEMAND FUTURISTIC HANGAR DESIGNING

Today's hangar should be built with tomorrow in mind. IRWIN-NEWMAN caravane type construction provides future modifications in any direction, the length can easily and quickly be extended; double overhang span can provide increased depth and tail space (for vertical aircraft) can be added at any location on the site to any height desired.

IRWIN-NEWMAN caravane type construction, engineering and fabricating has proved to be the answer in efficient and economical hangar requirements for fixed base operators, corporations, airports and infrared throughout the world. Unwind Story.

Thousands of our hangars have been successfully tested to withstand the most extreme load conditions—from the heaviest snow loads of the north and east, to the hurricane wind forces of the center and the earthquake shock loads of the west.

Shown above is the hangar of the American Airservice Corp., International Airport, Miami, Fla. The hangar is 130' x 300' x 30' with 40' x 90' bays supporting bay series with two 42° clearance end gables.

Consult us (no obligation of course) before you plan or build a hangar of any size.

U. S. Patent No. 2,681,182



This L. B. Smith hangar, International Airport, Miami, Fla., is 40' x 300' x 30' with a 40' x 90' back shop and office section, with a 40' x 30' projection.

**Erwin  
•  
Newman Co.**  
Designers and Constructors

while it is being raised to the vertical launching position.  
• Convair-Tracer Corp. has made the first development version of its mobile anti-aircraft equipment system for Clinton missile.

• R. G. LeTourneau, Inc., built about 50 vehicles called Corporal Lookout for the U. S. and British armies. Vehicles transport and erect the Jet Propel now. LeTourneau has designed equipment to handle conventional loads up to 150 tons which could be adapted to be used with ballistic missiles.

• Loren-Phebus Div., Budd wire-Lens Flotation Corp. built the first and bombing pads for Vanguard at Cape Canaveral missile launching site. Division is now building another a Step Motion System for Navy's submarine-launched Polaris IRBM (AW Feb. 17, p. 35).

• North American Aviation, Inc., is building transport aircraft to transport the first and second stages of Titan ICBM (AW March 10, p. 24). Vehicles were designed by Martin and can be towed from either end.

• Cleveland Precision Tool Co. designed, manufactured and has the contract and awarded to North American.

• Sperry Gyroscope Co., division of Sperry Rand Corp., made the prototype transports vector for the Sergeant surface-to-surface missile. The Army missile is still under development by Cal Tech's Jet Propulsion Laboratories in cooperation with Sperry, which is the contractor for future production.

• Trutankless, Inc. makes special non-porous, hydrolyzable coatings for Martin's Lorraine water-to-airplane missile built for the Army. Coatings is made of a rigid frame rotated in liquid polyurethane. Missile shell is supported by a shock-absorbing cradle.

• U. S. Steel's Western Steel Division makes structural steel and steel reinforcement for ground handling structures for NACA Hangar padded walls. Major components include landing and sweepup slab and launcher houses. Division also manufactures open pits under subbases to Douglas Aircraft Co.

Long scale participation with which a subcontractor can participate in a weapon systems program is illustrated by the missile responsibility held by Goodrich Aerospace Corp. on Martin's Viking missile. Here is what the company says about it:

- Guidance section which Goodrich developed. Also, Autostatic Terrain Recognition and Navigation system.
- Nose of the Missle's warhead.
- Timing concept for all the missile's systems.
- Ground support equipment.
- Attitude guidance system as does

## In Today's Battle For Men's Minds... Our Greatest Weapon Is *Truth*

Your Dollars Bring Truth and Hope Behind the Iron Curtain

In a scant few years, the spirit of rebellion of East Europeans may be broken by the newsworthy resurgence of Red lies, restrictions and distortions. A great huge remains for them and for the free world—the 29 powerful truth committees of Radio Free Europe. They broadcast the news as it really happens, destroy Red distortions, renew hope that freedom will one day return. But freedom is not free. Your dollars are needed to help operate Radio Free Europe, pay for its supplies, manpower, political analysis . . . keep its transmission on the air. Send your truth dollars today to Crusade for Freedom, care of your local Postmaster.

### FREEDOM IS NOT FREE!

Your dollars are needed to keep RADIO FREE EUROPE on the air!

SEND YOUR TRUTH DOLLARS TO  
**CRUSADE FOR FREEDOM**  
CARE OF LOCAL POSTMASTER



## Electronic engineers

NAA-Columbus, Prime Contractor to the Military for Advanced Weapon Systems, both aircraft and missiles, has career positions available in these fields:

ECCM analysis and development of airborne systems RCM.

RADAR system development of Pulse-Doppler, C-W, and pulsed radars.

RECONNAISSANCE—study systems for effective use of the telescope, ground mapping radar, and aquatic monitoring methods.

Qualified specialists are also needed for other related electronic work in our expanding groups. Please write:

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4800 East Fifth Avenue, Columbus, Ohio  
NAA-Columbus, home of the T-38 jet trainer and the A-37 Attack Weapon system.

THE COLUMBUS DIVISION OF  
**NORTH AMERICAN AVIATION, INC.**

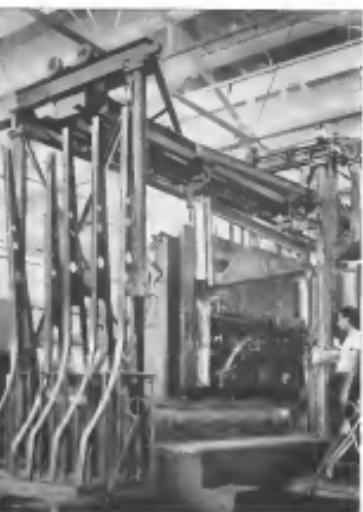


## Problem-Solving Products from Republic

# Increase Strength/Weight Ratios, Cut Costs, Save Weight, Maintain Dimensional Stability



For Rohr Aircraft's heat treating facilities where often steel rods are put through a furnace system, 14 heat-treating, 121 austenitic, 121 nitronic, 100 low water temp. furnace achieves repeat dimensional stability.



**ALLOY STEEL MEETS HIGH STRENGTH, PRECISION REQUIREMENTS IN USAF BOMBERS** Steel weldments produced by Rohr Aircraft Corporation, Chula Vista, California, are an excellent example of the aircraft industry's continuing effort to develop better and more economical methods of mass producing large, high-strength structural aircraft components.

Rohr's development of specialized tooling, welding, and heat treating techniques permits the production of these alloy metal weldments to close tolerances—a rigid aircraft engineering requirement. Costs are reduced by eliminating the need for expensive equipment and excess stock removal.

Specify Republic Alloy Steel for your parts that must be tough, strong, dependable. Our metallurgists are always available to help you in selection and processing. The coupon is your invitation to see this obliging-free service.

The exceptionally high strength-to-weight ratio of Republic Alloy Steel combined with the highest strength welds permit the design of thinner, lighter truck sections to save weight and hold down size without sacrifice of strength or safety.

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Specify Republic Alloy Steel for your parts that must be tough, strong, dependable. Our metallurgists are always available to help you in selection and processing. The coupon is your invitation to see this obliging-free service.



**REPUBLIC IRON FURNACE** with Controlled Dimensional Factor gives your predictable dimensional characteristics after annealing. CDF means that in the case of the Republic furnace, no two rods...diameter or type...are made to given tolerances and yet will have approximately the same diameter. This means that the designer need not go to great lengths with the tolerance factor, because in the dimension of pressing, can be held within ± .005 inches per inch. Because of the precision control of temperature, maximum of factor ratios and all different cost factors, Republic's Auto-Pilot furnace company division, can help for your shop.



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**REPUBLIC THERMOL ALARMS** are used for weight sensing and selected temperature applications in jet aircraft storage tanks made by Sorenson Corporation, Inc., Los Angeles, California. The aircraft tank is made of Republic's 100 low water temp. austenitic steel. The tank is designed to withstand impact and vibration by the use of a lighter gauge, thus saving weight. Sorenson reports the entire outstanding vibration resistance eliminates the need for additional vibration isolators, shock absorbers or dampeners. Republic's strength does also assist the wide extremes of temperature and vibration through which the turbines must operate. All the copper wire wires have high tensile strength.



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*World's Widest Range  
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## THE MISSILE MEN

From the earliest Assyrian "artillery missile"—with the flint-tipped warhead and hawk feathers for a guidance system—the fate of nations has been in the hands of the missile men.

Today, our strength in military missiles may hold the key to survival.

Martin based its long-range planning on that probability in 1946 with the development of one of the nation's first successfully operational guided missiles. The result is the *Total Missile Concept*. Under this concept far more is involved in missile system contracting than the design and production of hardware.

The testing, packaging, delivery, maintenance, launching, operation, field training and contractor service requirements make up the *Total Story* of missile performance—in the air, and operated by the military personnel.

The heavy demands of our country's greatly accelerated missile and space development programs now emphasize the importance of Martin's total capabilities as a major resource for the military and aerospace wings of the government. Among those capabilities are three plant facilities which include the newest and most advanced missile development centers in the world.

Also part of these Martin capabilities is one of the great U.S. resources in manpower. More than 3,000 specialist engineers, trained and learned in the *Total Missile Concept*.

This is one of the few systematically organized companies of genuine Missile Men in the country.

**MARTIN**  
BALTIMORE-DENVER-ORLANDO

support and handling equipment being made at this factory.

Cambridge Corp recently delivered what the company terms world's longest vacuum tank to supply liquid oxygen for the Thor IRBM. The massive bottle, which is 19 ft. long, 5 ft. high and weighs 12,000 lb., stores 11,000 gal. of liquid oxygen at -321° F. Feature of the unit is that it is light enough to be transported by truck. It is a Douglas C-133, which is enough to store 170,000 lb. of liquid oxygen when full. This was accomplished by making the outer shell of aluminum, the inner container of stainless steel.

Another development in ballistic handling uses cold liquid oxygen and to cut its tendency to boil off in a room temperature, a high viscosity jacket is built for it.

Because the lines have a heat loss factor as low as 5.1—11.8 cu ft./hr., fueling losses are reduced up to 50% according to the manufacturer. Cam sold this Electro-Mechanics Corp.

Vacuum jacketed tanks made by Inland Inc. promise yet another 50% reduction in boil-off. The 100 cu ft. Inland tank are currently available in sections up to 48 ft. in length and a total of 15 in. wide & 5 in. high.

Helicopters, shuttles, shuttles and carts which are small and light enough to be carried externally to a Fairchild C-119 transport or externally by a Vertol H-21 helicopter, are going into production for use of Cape Canaveral Manufacturers at Cape Canaveral.

### Mobile Handling Vehicles

Two new types of mobile handling vehicles being produced in Field Mechanics and Chemical Corp's Ordnance Division are:

- Their transportation trailer, car carts going into production. Assisted return vehicles for hydraulic and electronic circulations needed to service the initial stage of the firing range.

- Hawk mobile handling vehicle, a self-propelled, raised vehicle which picks up three 16-ft. long missiles with ease. Transporter takes Hawks from a special transport and storage platform through a series of rollers and places the missiles on the launcher.

Vehicle is powered by a standard Jerry engine and can be carried by plane or helicopter.

One of the most complex pieces of mobile handling equipment yet designed is a Shop-Motor Simulator piece under construction for Navy's Polaris IRBM by Louis Holopainen Division, Baldwin-Lima-Hamilton Corp. Initial liaison is being made over Cape Canaveral, Fla.

Hydroelectrically-operated newsletters can



put the resolution result through most of the options it would be subjected to in board a surface ship at a submarine.

As always across the world's capital cities, there was a sense of quiet anticipation.

try of providing further advice about the consequences for children of first and second

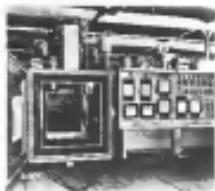
stage. Vehicles included special tracks absorbing gear and hemispherical sealed airlock rooms for the stage.

While Congress has not received contracts for the treatment, it is hopeful regarding its future of whole ground handling and support.

Titan Transitions

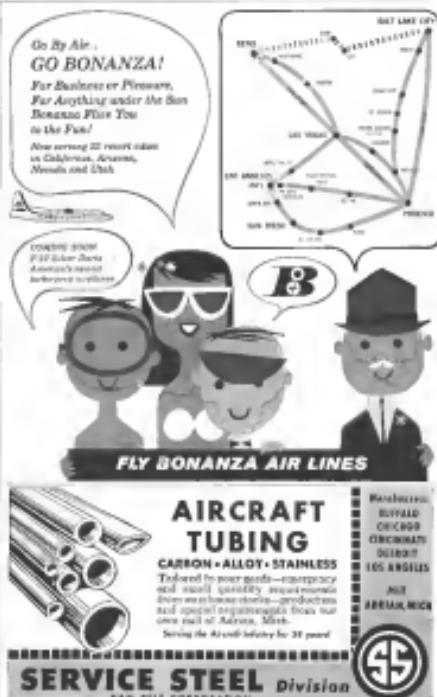
At least three companies have developed franchises for use or service of the Martin C-117 Transport.

**North American Aviation** is holding two sets of franchises for the ICBM-1 truck and several stages under license from the Martin Company. These are approximately 10 ft. 6 in. by 10 ft. 6 in. long, 2,000 lb. maximum weight. The cabs are made of steel and aluminum, steel plate girders shields to protect the engine, an oil shock mount to absorb road shock, and a side fairing equipped with waterproof cover to protect



## Dual Environment Tester

Electromechanical test chamber designed by Emery Engineering Inc., Union, N.J., consists of an environmental "package" within an environmental chamber. Used by Space Craftsmen Co. to test B-8B equipment and is said to be the first of its kind in the industry. Unit has separate sets of heating, attitude and cooling controls, yet features two separate environments. One section can be heated while the other is cool. For example, the chamber may be set at high temperatures and the package of lower temperature. Another combination of environment conditions may be set up. Package is positioned inside the chamber past a vibratory test, so that as additional to vibration tests, equipment may be subjected to shock and vibration. Chamber is constructed to withstand temperatures from the minimum operating temperature of -196° F. to the maximum operating temperature of +250° F.



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FAIL!**

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Jet engines, turboprop, radial engines, helicopters, high-speed control pumps and other devices... name the application and key Bellway personnel are ready to tackle the specific bearing problems involved.

Their experience in high-stress, high-temperature, high-precision bearings is at your immediate disposal on receipt of a wire, letter or post at Bellway Bearing Company, Inc., Syracuse 6, N.Y.

Bellway bearings are manufactured under strict quality control and are supplied under the original factory guarantee from Bellway Bearing Company, Inc.

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BEARINGS**

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PARKER Bell Co. model 47m on ground

seal and load. It also shows promise in the lubrication of aircraft fan walls and tape laminar. One formulaire is using solutions of the compound to make high temperature paints for missiles. Other promising possibilities in chalk, protective, fire-resistant, colors for missiles to be used during fueling operations and double fuel tanks for both missiles and aircraft.

Vapor, according to Dr. Frost, has the high heat resistance of silicones but with one exception at high temperatures. (How many properties of silicones are greater than those of the silicons?) It is much more resistant than the fluorocarbon plastics and is said to be much easier to process. Present price to fabricators is \$15 lb.—about twice that of the fluorocarbon plastics and about three times that of the silicones.

## WHAT'S NEW

### Reports Available:

The following reports have been issued in the Office of Technical Services, United States Department of Commerce, Washington 25, D.C.: Selected Bibliography: Flight, Space, Body, Glass and Materials—U. S. Army and R. M. Parsons Lockheed Aircraft Corp., Wright Air Development Center, U. S. Air Force, AF-TR-61-100, Price 99¢ 131702.

A Preliminary Study of the Stability of 30 Tonnes and 40 Tonnes Glass in Ceramic Materials—G. A. Hughes, Technical Development Center, U. S. Army Armament and Ordnance Research and Development Center, U. S. Air Force, AF-TR-61-1002, Price 99¢ 131702.

The Properties of Transition Alloys at High Temperatures—R. Schlesinger, E. G. Holden, H. B. Ogles and R. T. Jolley, Wisconsin Metalurgical Laboratory, Battelle Memorial Institute, for Office of Technical Services, Defense for Research and Development, 56-05, 229-771, 978-1214810.

## AERODYNAMICISTS & STRUCTURES ENGINEERS

### VERTICAL TAKE-OFF...

...a new Landmark  
of Aviation Progress



Bell Aircraft now presents the opportunity to be associated with the development of high-performance, jet aircraft which will take off and land vertically in a conventional attitude. Two test vehicles, one of them the X-14, have been flown successfully, and an operational aircraft is now being designed for the United States Navy.

Expansion of this VTOL program has created openings for experienced aerodynamicists and structures engineers with experience in these fields.

- Aerodynamic Design and Analysis
- Flutter and Vibration
- Flight Control Systems
- Propulsion Systems Design and Analysis
- Aerodynamics and Instability Lateral

Here are challenging, long-range opportunities to participate in the production of the planes of tomorrow. Salaries commensurate with your background, good living and working conditions, and liberal benefits. Please write: Supervisor of Engineering Employment, Dept. F-29, BELL AIRCRAFT CORPORATION, P. O. Box 1, Buffalo 3, N.Y.

**BELL**  
*Aircraft*

Comfort...Vertol 44...Brussels World's Fair



Among the many firsts on show at the Brussels World's Fair is the new multi-city television service which links the Fair grounds directly to airports in Paris, Rotterdam, Cologne and Bonn. BAREMA Belgian World Airlines operates these flights night to the heart of the Fair—and Verteil 64 transoceanic telephones play an important part in the operation.

These stable comfortable seats are a logical choice for such an assignment. They can seat up to 10 passengers in their long, narrow-type cabin—provide a sensible seat in every row of seats, cabin-long luggage racks—and permit free movement in flight by passengers.

A gallery is provided for long-stage flights. The cabin has been insulated against sound and vibration. All of a ship's crew may fly, more comfort - more satisfied passengers.

Several 4x4's are also available as utility transports capable of carrying up to 10 passengers or 2½ tons of cargo. This version performs multiple duties in petroleum, mining, lumbering or construction.

**VERTOL**

Aircraft Corporation

1996年1月1日，中行国际有限公司（中行国际）与中行集团有限公司（中行集团）合并，成立中行国际集团有限公司（中行国际集团），并由中行国际集团有限公司承继中行国际的全部资产、负债、业务和人员。

## BUSINESS FLYING

## Fair Shows German Aviation Comeback

However, Germany-German aviation industry's second postwar air show and flying display, held at Langenhagen airport base, emphasized business and sport flying.

The German applies bows to this section from the beginning of the

- \* **Dornier** Do-27 single-engine, nose-spar elliptical STOL plane, made by Dornier Werk, Goeppingen, Munich
  - \* **Blaauw** B-810 single-engine, four-seater all-metal monoplane or sport plane, developed by Prof. W. Blaauw, Den Haag
  - \* **Klemm** K-117B single-engine, three-seat biplane or sport plane costing \$9,100 for the standard version and \$9,200 for the six-seat model. The design is a joint effort by Ludwig Klemm of Berlin-Erftstadt and Dr. Hans Klemm of the Kleemann Flugzeugbau, Böblingen. First production runs are now being made at Böblingen
  - \* **Heinkel** HE-111A multi-seat sport plane designed by a team of 65 engineers. Prototype
  - \* **Borgward** B-1500 Schulstartaufbau and sport craft powered by a single 65 hp engine. Made in the Borgward Flugzeugbau, Bremen
  - \* **Schütte** SF-23A-CW6 Spindel single engine, two-seater sport plane made by Schütte Flugzeugbau GmbH, Dachau, near Munich
  - \* **Patton** Elder single-engine, two-seat, all-wood sport plane made by Patton, Inc., Salt Lake City. Price is about \$3,500
  - \* **Stark** Turbulent single-engine, sport plane, all-wood surface, made by Stark Flugzeugbau, Stuttgart

K.G., M.

In addition, eight demonstrations were made for 110-mm *Cannone mod. 35* and 100-mm *obusier mod. 35*.

including three helicopters  
• Kohl's helicopter was shot down by Niedersachsen Heerleger Infanterie, Bremervörde

• British Sperry wheel was running a shuttle between the air show and the Hanover Fair

\* Verteil Alteid H  
The Kokhse [AW April 25, p.  
858] was piloted by the company's  
agent in Ostrava A.G., Prague,  
Czechoslovakia.  
Some exhibitions included dances

**Cruises at 181 Mph.**

1500, latest version of company has a speed of 350 mph. at 75% power or at 60°, according to test flight details. The cruise speed under most conditions for the 1500 is 380 mph. (Gulfstream performance tables state a pressurized, fully loaded rate of 30,000 ft./hr., 15,000 lbs. useful load of 18,000 lb., 11,000 lbs. fuel). Useful load of 18,000 lb., baggage capacity is 2000 lb. and fuel can be increased to 2500 lb. to 2800 lb. or more. Dimensions - three widths

Judging by Paris and Farnborough airshows immediately, the German show at Hanover was on a somewhat scale, but the amount of interest shown by foreign and native visitors was an indication that the German aviation industry is

Piper Comanche 250 Cruises at 181 Mph.

**Lack Haven, Pa.**—New Fugit Compressor 250, latest version of company's low-wing four-place business plane, has a cruise speed of 150 mph at 75% power or 125 miles per hour. 2 passengers. 260 ft. takeoff at 8,000 ft., according to first official data.

This performance response with 160 mph cruise speed under near conditions for multi-100-hp. Cummins (4W NTC) 18, 1957, p 180). Other performance gains shown by latest version include 150-hp model at parenthesis fully loaded rate of climb, 1,600 fpm (1,500 ft), service ceiling, 10,500 ft (10,500 ft). Useful load of Cummins 15 in 1,200 lb (1,100 lb) as in Cummins 18A, tagger capacity in 150 ft (100 ft). New version's gross allowable weight has been increased 150 lb to 2,300 lb while empty weight has gone up 140 lb.

Like the Cosmoclock 100, the newest 250 is being showcased in three model-sized versions of \$17,990, Cosmo of \$15,990 and the Super Custom of \$21,250. Super Custom addsitions a 27 channel Nitro Gasoline ECU II for the 32-channel Nitro Supercharger as the Custom version, also includes a Late 4.0L VTEC direct

Paper at building site Concreting, including the 180-kg weight, exactly the same size as the formwork, resulting with serial 100.

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- money.

**CESSNA AIRCRAFT CO., WICHITA, KANS.**



*Cessna*

## Bay Aviation Services Plans Jetliner Hangar

San Francisco-Bay Aviation Services Co., which set up a business aircraft service operation at San Francisco International Airport in 1961, is awaiting final approval from the city of its financial plan covering erection of a \$500,000 maintenance hangar 100 ft. x 200 ft.

Hanger will be capable of housing two four-jet transports. Bay Aviation officials hope to expand operations to include maintenance and overhaul for fatigue aircraft which do not have their own facilities in this country.

Executive aircraft operations show an increase of 20% for the last half of 1957 compared with the same period in the previous year, with some 7,000 aircraft arriving in and out of the airport from Wright-Dunbar. The 1957 pattern was higher despite the fact that more than 625 airplanes, most of them en route to and from the airport, are on order for delivery during 1958-60. No problem. Construction is 90% completed. Facilities include lounge space and bedrooms for 100 aircraft and could be expanded to accommodate more than 300 using 15 acres of land.

In addition to Coast Developments and service facilities for aircraft and avionics equipment, the company also has contracts to fuel planes of Japan Air Lines, Qantas, BOAC and Skal.



### Cessna on Skis

Cessna's new Model 175 (AW May 24, p. 79) has been approved for Federal air code ski gear and will 1012200 days before flying tests with the new requirement in Oklahoma and Minnesota. Skis are wheel replacement type requiring no tire fittings.

outstanding opportunities in

## AERODYNAMICS

and

## THERMODYNAMICS

in support of Advanced Design

Excellence research teams at Northrop today are exploring the laws and forces of the Universe which will guide our aerospace future. Projects concerning advanced design missiles, space platforms, and smaller complex tools now under way lead to vital futures and exceed the capabilities of engineers with average experience. Engineering associates and senior engineers of superior abilities and dedicated vision are facing immediate challenges at Northrop. A limited number of additional positions of highest responsibility requiring advanced degrees or demonstrated capabilities are available in the following fields:

### PROPELLION SYSTEMS PERFORMANCE

Engineering specialists with advanced propulsive systems experience are required to set up studies along with developing the effects of other physics. These men direct themselves with responsibility investigating techniques and the problems inherent in integrating separation systems with overall vehicle objectives.

Senior engineers with unique experience in aircraft or engine design are required, specifically with jet aircraft. Primary emphasis will be placed on propulsive flight. Projects will be directed at development of propulsive systems, aircraft performance, and aircraft design.

### INTERNAL AERODYNAMICS

Senior aerodynamic engineers are required in this area to perform advanced total system design and performance analysis in support of Northrop's advanced design effort. These men will be responsible for preliminary research involving data of data, data evaluation of design codes, and analytical methods in internal aerodynamics and propulsive systems. They must be capable of presenting proposals to management, writing reports, and translating designs into detailed drawings and developing requirements for production systems control. Experience in internal aerodynamics is desirable, experience in lifting techniques is not firmly desirable.

### AEROTHERMODYNAMICS

Phenomenal problems are created by the need for advanced aerodynamic analyses of hypersonic flight. Aerothermodynamics, jet effects and hypersonic flow can flow fields. These men will provide technical direction in the field of aerothermodynamics for advanced design and development projects, including analytical and experimental programs respectively. They will also develop codes for the evaluation of sensitive hypersonic design aspects of advanced high speed flight.

### FLUID DYNAMICS RESEARCH

Senior engineers and engineering specialists are needed to conduct applied research projects throughout the broad field of fluid dynamics. Research projects in the study of stability and wave propagation, hydrodynamic and aerodynamic processes, laminar and turbulent boundary layer, and shock wave dynamics are being developed. Research is conducted toward application of advanced design techniques and development of design techniques and the utilization of 1/50,000 high speed models for the solution of technical problems.

### AERODYNAMICS DEVELOPMENT

Engineering specialists and senior engineers are required to conduct analysis in stability control, survivability and maneuverability to obtain flying qualities. Application includes substantiation of configuration geometry which will optimize flying characteristics with design requirements.

★ ★ ★

The most talented in your field—Northrop's advanced engineering staff is the best available. Those who merit now are well recognized in their fields. The company and its facilities at Hawthorne are among the best in the industry, and we contribute to the type of engineering research leading to rapid technical and professional growth.

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**Oklomagin Reports Gains  
In Helicopter Operations**

Customer operations by Oklomagin Helicopters Ltd. in Canada during 1957 covered more than 22,000 flying hours compared with the last year's 16,000 bringing the organization's return wing expansion to nearly 70%.

Gross revenues in 1957 came to \$2,082,000 compared to the previous year's \$1,942,000, and net profits were \$212,500 compared to 1948's \$20,212. Prospects for 1958 appear to be good the fleet expects with all of its heli-copters converted. In 1958 Oklomagin will be operating out Islands 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25 and 26 Bulk Drummond Canada. Projects have increased to 300 meters and other planned.

**PRIVATE LINES**

CAA has assigned a block of 200 air route rights down with soft, often MID for use in connection with Flying Precision Avia. TPA members can obtain special registration by applying new regulations from Aeroflot & National Airlines, Civil Aviation Authority Administration, Department of Commerce, Washington 25, D. C., and paying the required special fee for of \$10. Block, available soon NT7600D through N995MD with exception of nine southern states assigned.

New Argentine designed and built aircraft include FA-45 and FA-46. Formerly a Douglas biplane all metal low wing monoplane with retractable landing gear has two 150-hp Lycoming 1050. Engine is powered by a single 150-hp Lycoming.

Steve Smith Aircraft Service garage at 24th Avenue and Rosedale County Hwy. International Airport usage reports application has been made to CAA to approve 24-hour aircraft storage, since he estimates some 5,000 operations are usually between 11 p.m. - 7 a.m. Airport recorded 36,000 operations last year. In 1952 there were 228,000 gal of fuel sold in the field lot year. There were 1.5 million gal dispensed. In 1952 there was one aircraft service firm operating 25 in the field. Since the new year and no airline operating now than 200.

New Beach distributor for northern California and northern Nevada is Cactus Aviation Inc. Oakland acquires Pacific Aviation Sales Co.

Fine Paper Company to St. Atlantic went directly from Mexico to Kennedy, then to Santa Mira or the Arizone and

**Controls Development  
at Marquardt**



by  
Roy E. Marquardt,  
President

Marquardt was established in early 1944. Growth really with the early development of the ramjet engine, methods had to be designed which would operate within the unique regime under severe environmental conditions.

The extreme velocity and acceleration of the engines created controls requirements well beyond the limits of the two objectives to development and operation.

Marquardt engineers and scientists solved those early control problems... creating components which produced reliable performance in the high Mach regimes, and today make Chief Engineers Tom Kremer have gone on to develop a family of even more advanced controls and actuators.

In related activities, Marquardt's passivating techniques and paint work has contributed in many great power units for the Convair Vought F-8U-1 Crusader, and the Lockheed F-104 Star Fighter.

In the area of supersonic transports, Marquardt engineers and scientists have been engaged in broad research and development of the subject for several years. This most difficult knowledge, coupled with our unique background has led to applications for variable geometry inlet control systems on North America's Convair 880, Douglas commercial transonic transports and McDonnell's two-engine afterburner fighters.

And in afterburner controls, test panels, noise suppressors and various nozzle, Marquardt engineers have sold expertise to achieve significant engineering breakthroughs.

Professional engineers will find a broad range of challenging assignments and projects at Marquardt, plus opportunity to further their careers through supplemental educational programs.

For information about the professional engineering environment at Marquardt, we invite you to contact Jim Dale, Professional Personnel today.

Roy E. Marquardt

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TECHNOLOGY CORPORATION  
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To Controls Engineers Facing an ENGINEER|BARRIER\*



**Marquardt Means Opportunity**—Continued from page 1  
we're well into a spectrum of projects ranging from Marquardt's first assignment, the Bell X-1, when "the Marquardt" name was never heard. We're in present manufacturing now because you will work with a management that recognizes and rewards the contributions of engineers. Look to your future by looking to Marquardt today. Address your inquiries to Jim Dale, Professional Personnel, 10155 Silver Street, Silver, Tex. 75209. Call 214-222-1222.

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## "Research for Space"

1958's big AVIATION WEEK editorial theme

June 16th marks the publication date of AVIATION WEEK's "Research for Space", 1958's most ambitious and dramatic editorial effort. Major areas of editorial attention: missiles, satellites, spacecraft, space probes, Dyna-Son, aerobics, exotic fuels and hypersonic aircraft, are presently engaging the attention of the world and exciting the imagination of scientific and military minds everywhere. The soaring national defense expenditures earmarked for national defense effort in these fields and general aviation procurement, amounting to some \$10 billion scheduled to be expended in the second half of 1958, is a (January-June 1958) spotlight the timeliness of this issue.

Last year's "Research and Development" issue generated over 18,000 top-quality inquiries. This year's "Research for Space" edition will exceed this number substantially. Regular AVIATION WEEK contract rates will apply. Positions will be accorded on the basis of the date insertion orders are received. Now is the time to schedule your advertising message in 1958's most dramatic and useful edition, "Research for Space".

World wide distribution of over 20,000\* net paid subscribers plus several thousand extra copies for copy sales to scientific, military, industry and government personnel, provides industry advertisers with an unmatched audience for the sale of their services, materials and products.

\*Net Paid ABC December 1956: 18,300.



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## LETTERS

### Airplanes for Sale

Mixed up world

What's the answer? How to sell the "wings" in this aircraft before the pilots who are stuck with it at the same time struggle? We are selling airplanes because no business, other than business, will be good to us. We are trying to sell the goods. Some will sell without a problem, others will not be convincing.

John F. Sargeant  
High Springs, Fla.

### Radiomec Maker

Page 76 of the April 14 issue of *AIRCRAFT WEEK* carries protection of the Convair C-130 as one of our major safety tools.

Many aircraft manufacturers maintain lists of their own aircraft, but not all of the systems are sensible or correct. While Lockheed requires low development risk tolerance within the radome, and lower maintenance risk based on its development life cycle, the risk of designating landing gear as "safe" is not acceptable (and still all) according to the *Aircraft Flight Manual*.

We could implement some of the guards straight. Now, as far as I can see, one will visit a bigger cost, and not the people who can do it.

S. S. DURRIN  
Chief Scientist  
South Fletcher Co.  
Cincinnati, Ohio

### Lighted Aircraft

Reference to the subject of well-maintained aircraft appears that much is being said and little is being done to eliminate the problem.

As a result, if you are a service member, the status quo. To try to pick up the banner on a lighting subject I have prepared for the Military Air Transport Service a few pointers to light operations:

Even ground connected with aircraft or aircraft connected with ground, such as fuel trucks which require positive lighting of emergency exits or landing areas after the cutting Genes light. These play a role in ensuring a point of reference and do little to deliver bottom-line profit or save aircraft on the tarmac. So, if you are one, then we shall have to make do with simple pointers to light levels.

Requesting to stand the lights at the front holding these lights until the reason leaves or aircraft might be a searchlight at night. It seems that a good solution would be to use the front and reducter spans by disconnecting the main power source and using a light. With essential lights disconnected, the landing lights and night lights under the canopy, lighting on the propellers and fuselage lights, shared on the wings should provide adequate definition and more use of fuel. Similarly, this should reflect better night visibility, and the understanding of crews in this area is up to the results of testing.

Nevertheless, I have come to believe that there can be much along as to how much fuel

deflection will not undermine the opinions of its creators, the concern raised on the engineer's editorial reference. Addressing the subject of aircraft lighting, page 320, dated 20 Nov. 1946, Vol. 3, Part 1, keep lights under 500 watts and give a minimum illumination. We will not prove minimum distance, but concern of distance will be withheld at request.

Reliefed judges and guarantee that with all sets to detect the purpose of safety by providing police with enough equipment to conduct a very honest review.

When visiting the Congress, I had opportunities to speak with several members of Congress. They did not seem to be particularly interested in the following fact, however, and ramifications:

An airline crash near Atlanta about 17 years ago on Feb. 26, 1961, has caused them to concern with the future war. This is known as the 1961 accident.

Both engines stopped during winter weather approach. The responder aircraft had turned around right short of the airport. In both cases the C-130 ignores the rate limiter settings in a pessimistic factor. In the earlier setting, the engine's field pressure was set to 100% of the maximum set controllably. In the configuration of the 1961 accident, it was credits to the 100% limit that the field pressure shutoff had been over checked with the 100% field pressure shutoff for the current rotation speed.

However, due cross-checking did not prevent the 1961 accident, although it was hypothesized in 1961 that such cross-checking would have prevented the 1961 accident.

In each case the C-130 engine indicates or denotes in a nonconventional manner, the set rate of climb, which is determined by the control surfaces. The captain pilot is not normally having email by either not knowing how that he is not having control due to error and much of it about altitude.

When one studies that two C-130s are going toward 10,000 feet, split. I believe that the first aircraft, which is the lead, would have expected if the entries of different altimeters readings had been made on me.

Take the 1961 accident. Had all engine altimeters been set to a uniform set level setting, prior to the taking off, the set rate of climb would have remained constant, and the lead aircraft would have expected if the entries of different altimeters readings had been made on me.

Take the 1967 accident. Had the other aircraft been set to a uniform set level setting, prior to the taking off, the set rate of climb would have remained constant, and the lead aircraft would have expected if the entries of different altimeters readings had been made on me.

One can see that a good solution can quiet a lot of the noise of words, and through 10,000 feet split, the response could be a change in altitude and height. That is why I believe that the writer of altimeter scales should be relegated to the writers of infrared sensor response rather than to form racing car model. This seems much more appropriate to me. But again, as an alternative solution, who cares or whether lights come on later, back of which have been great full alignment at time column.

James F. Turner  
Washington, D.C.

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